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FIRM-LEVEL LEARNING AND PERFORMANCE IN THE MANUFACTURING SECTOR ETHIOPIA

BY
ABDI YUYA AHMAD

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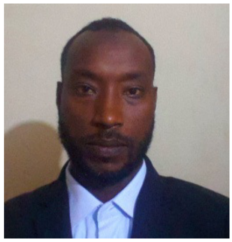

Abdi Yuya Ahmad is a PhD fellow pursuing his study under a joint PhD program at the Department of Business and Management, Aalborg University, Denmark and Division of liberal and social science at Adama Science and Technology University (ASTU), Ethiopia. He obtained his M.Sc. in Economic Policy Analysis from Addis Ababa University in 2008 and a B.A. in Economics from the Ethiopian Civil Service University in 2004. He was awarded Mekonnen Taddese's Memorial award for the best BA thesis of the year in 2004 by the Ethiopian Economic Association. His research interests relate to the micro-foundation of economic development with special focus on firm level learning and innovation.

Starting from 2008, he has been working as lecturer at ASTU's department of Economics teaching different undergraduate courses, supervising undergraduate students and Co-supervising M.Sc theses. At the beginning of 2013, he started his PhD in economics at ASTU. In 2014, he spent 3.5 months as visiting research fellow at the Institute of Economic Research of Seoul National University, Korea. His first visit to Aalborg University was in 2015 when he was selected as one of the first Africalics visiting PhD scholars. His affiliation with the Africalics network goes back to November, 2012 when he participated in Africalics PhD academy that was held in Nairobi, Kenya. He also attended the PhD academy that was held in 2015, Mombasa, Kenya. Alongside, his PhD, he has been coordinating and undertaking the Africalics seed-fund research project on 'Natural Resource endowment and firm level innovation in Sub-Saharan Africa: Evidence from a multi-country analysis'.

Parts of the current PhD thesis have been presented on the twelfth and thirteenth Globelics conferences while one paper has been accepted for the fourteenth Globelics international Conference to be held in Bandung, Indonesia. The very version of the thesis was presented also at the Catch-up seminar in Seoul, South Korea which was later published on the proceedings of the 12th Globelics conference that was held at Addis Ababa, Ethiopia. One of the papers in the current version of the thesis was published on the *journal of Innovation and Development*. Apart from the current thesis, he is a co-author of a paper published on the *Ethiopian Journal of Business and Development*.

ABSTRACT

Ethiopia is the second populous country in Africa and among the poorest countries in the world. The country's economy heavily depends on rain-fed agriculture with backward agronomic practices. Modernizing the agriculture sector and making it a springboard for industrialization is at the center of the country's plan. Ethiopia aspires to be a manufacturing hub and to reach lower middle-income level by 2025. Manufacturing is considered a more dynamic sector due to its high potential in creating less-skill demanding jobs and its economy-wide impacts through facilitation of backward and forward linkages. Besides, the sector is believed to be an engine of growth, as it constitutes activities that involve technology importing and opportunities to integrate into the globalizing production systems. However, successful absorption of foreign technology and integration into the global value chain is crucial in building local technological capabilities that would help an economy to be more competitive. Over the last two decades, the Ethiopian government has taken visible efforts to develop the manufacturing sector by inducing more investment from both domestic and foreign origins. Fostering the emergence of dynamic competitive firms with the learning culture and capacity for continuous skill upgrading and innovation has been in the government's strategic interest. Against this backdrop, the thesis aims at examining whether there is evidence of learning in Ethiopia's manufacturing firms.

Foreign technologies are the sole source of learning and innovation for firms in countries like Ethiopia. The extent to which firms become competent and hence achieve greater performance depends on their learning capabilities, which in turn rely on internal organizational capacity. Thus, building firm-level technological capability involves the interplay between exploiting internal knowledge stocks and access to and the capacity to utilize external knowledge. At the sector level, learning is a key driver of structural change in which competitive firms grow while incompetent ones are forced to vanish. Inducing the shifting of resources from less productive to more productive sectors would also help boost aggregate productivity. Therefore, this thesis is organized in such a way that all the possible impacts of learning can be accommodated.

The overall contents of the thesis can be broadly divided into the background section (Chapters 1, 2, and 3) and the empirical section (Chapters 4, 5, and 6). Chapter 1 constitutes the general background and the conceptual framework of the thesis along with summaries of the remaining chapters. Chapter 2 provides an overview of the macroeconomic conditions, key indicators of national technological capability, efforts, and the realized pace of structural change with a focus on the dynamics of the manufacturing sector. Chapter 3 explains the theoretical basis of the thesis on which the general model of firm-level learning was developed. The background of the country in Chapter 2 and the conceptual framework in Chapter 1 are related to the theoretical models presented in Chapter 3. The remaining three chapters

constitute empirical results from the analyses of different forms of learning with their corresponding implications on performances. Chapter 4 aims at eliciting the role of internal learning in terms of its effect on firm growth and survival. Chapter 5 examines the presence of learning through exporting and the impacts of technologies embodied in imported inputs and fixed capitals. Chapter 6 also explores whether increased entry of foreign firms involve positive learning effects or negative competition effects on domestic firms. Therefore, it is possible to see the common conceptual ground of the empirical chapters, which also fits into the larger framework of the thesis.

The data used in this thesis include both macro- and micro-level data. The macro-level data were obtained from databases of national and international institutions to be used mainly in Chapter 2. The micro-level data were sourced from the annual census of the large and medium manufacturing sector collected by the Ethiopian Central Statistical Agency. The data used in the empirical chapters span over the period 2000–2011 and constitute only firms with 10 and above permanent employees. Descriptive and econometric tools were widely used to analyze the data.

Results of the analyses show several types of alternative evidence in support of passive learning or learning-by-doing. These include the positive significant effects of productivity and size on firm growth and the significantly higher exit probability of firms in more concentrated industries. There is also robust evidence of learning-by-exporting and learning-by-importing technologies embodied in intermediate inputs and fixed capitals. More interestingly, we found strong evidence of learning through horizontal spillover of positive externalities from foreign to domestic firms.

From the government's ambitious plan of changing the economic structure in favor of manufacturing and the corresponding incentive measures on the one hand, and the dismal progress in the performance of the manufacturing sector on the other, one can imagine the shadow either of possible detours from principles or anything else that might have gone wrong. In general, there seem to be deficiencies in promoting firm-level learning and creating a more conducive climate toward building technological capabilities. To this end, the combined result implies the importance of continuous improvement of internal capability and absorptive capacity of local firms. From the policy perspective, revisiting the effectiveness of already existing institutional supports and strengthening the weak parts would help bridge the gaps between objectives and practices. Findings from the empirical analyses suggest that improving productivity or efficiency and capital intensity not only enhances firm growth but also helps to reduce the likelihood of firm exit. Promoting more export orientation, improving ease of access to imported inputs, and supporting technology upgrading can improve domestic firms' learning and innovation capability and hence accelerate structural change. Selective attraction of foreign investment to the country's strategic industries and creation of all possible interaction with domestic firms would play substantial roles in building local technological capabilities and help realize the desired structural change.

RESUMÉ

Etiopien er det næstmest folkerige land i Afrika og er et af de fattigste lande i verden. Landets økonomi er meget afhængig af deres, som benytter en relativt primitiv dyrkningspraksis. Landets hovedplan er at modernisere landbrugssektoren og at bruge det som et springbræt for industrialisering. Etiopien ønsker at blive centrum for fremstillingsvirksomheder og at nå middelklasse-indkomst i 2025. Fremstillingsindustrien betragtes som en mere dynamisk sektor på grund af dens store potentiale til at skabe flere job som kræver færre færdigheder, og dens virkning på hele økonomien gennem understøttelse andre sektorer i økonomien. Derudover menes sektoren at være en motor for vækst, da den består af aktiviteter, der tilvejebringer ny teknologi og nye muligheder i form af globaliserede produktionssystemer. Imidlertid er optagelse af udenlandsk etnologi og integration i den globale værdikæde afgørende for opbygningen af lokale teknologiske færdigheder, der vil hjælpe økonomien til at blive mere konkurrencedygtig. I løbet af de sidste to årtier har den etiopiske regering gjort sig synlige bestræbelser på at udvikle fremstillingssektoren, ved at sørge for både flere indenlandske og udenlandske investeringer. Regeringen har haft strategisk interesse i at fremme væksten af dynamiske konkurrencedygtige virksomheder, som har læringskulturen og kapaciteten til kontinuerligt at fremme evner til at lære og innovere. Med dette i tankerne, er det afhandlingens mål at undersøge, om der kan findes evidens for læring i Etiopiens fremstillingsvirksomheder.

Udenlandske teknologier udgør den grundlæggende måde til læring og innovation for virksomheder i lande som Etiopien. Hvorvidt virksomheder bliver kompetent og derfor producere bedre resultater afhænger af deres kapaciteter til at lære, der til gengæld afhænger af intern organisatorisk kapacitet. Opbygningen af virksomheders teknologisk kapacitet involverer kombination af intern videns-kapacitet samt adgangen til - og evnen til at udnytte - ekstern viden. På sektorniveau er læring en vigtig drivkraft for strukturelle ændringer, hvor konkurrencedygtige virksomheder og sektorer vokser mens de inkompetente er tvunget til at forsvinde. Overførelsen af ressourcer fra uproduktive sektorer til mere produktive sektorer vil også hjælp med at forbedre den samlede produktivitet. Derfor er afhandlingen organiseret således, at alle mulige påvirkninger af læring kan tages højde for.

Det samlede indhold af afhandlingen kan groft inddeles i baggrundsafsnittet (Kapitel 1, 2 og 3), og det empiriske afsnit (Kapitel 4, 5 og 6). Kapitel 1 udgør den generelle baggrund og begrebsramme for afhandlingen sammen med resuméer af de resterende kapitler. Kapitel 2 giver en oversigt over den makroøkonomiske tilstand i Etiopien, nøgleindikatorer for nationale teknologiske kapacitet, stående indsats, og det realiserede tempo af de strukturelle forandringer, med fokus på dynamikken i fremstillingsindustrien. Kapitel 3 forklarer afhandlingens teoretiske grundlag, hvorpå den generelle model for virksomheders læring blev udviklet. Beskrivelsen af baggrunden af landet i Kapitel 2 og begrebsapparat i Kapitel 1 er relateret til de

teoretiske modeller, der præsenteres i Kapitel 3. De resterende tre kapitler udgør empiriske resultater fra analyser af forskellige slags læring med deres følgende påvirkninger på performance. Kapitel 4 forsøger at fastslå vigtigheden af intern læring især i betydningen for en virksomheds vækst og overlevelse. Kapitel 5 undersøger tilstedeværelsen af læring gennem eksport og effekterne af teknologier indlejret i importerede inputs og fast realkapital. Kapitel 6 udforsker, om øget tilstrømning af udenlandske virksomheder involverer enten positive læringseffekter eller negative konkurrenceeffekter på indenlandske virksomheder. Derfor er det muligt at se det fælles konceptuelle grundlag for de empiriske kapitler, som også passer sammen med den større begrebsramme af afhandlingen.

De data, der bruges i denne afhandling, involverer både makro- og mikro-niveau data. Makroniveau data blev samlet fra nationale og internationale databaser og bruges hovedsageligt i kapitel 2. Mikroniveau data blev samlet fra den årlige optælling af de store og mellemstore virksomheder i fremstillingsindustrien, indsamlet af det etiopiske centrale statistiske kontor, Ethiopian Central Statistical Agency. De data, der bruges i de empiriske kapitler, er fra perioden 2000-2011 og udgør kun de virksomheder, der har ti eller flere fastansatte. Beskrivende og økonometriske midler blev i vid udstrækning brugt til at analysere dataene.

Resultaterne af analyserne viser forskellige former for evidens, som støtter passiv læring eller "learning-by-doing". Disse involverer både de positive signifikante effekter af produktivitet og størrelse på virksomheders vækst og den væsentligt højere exit-sandsynlighed for virksomheder i mere koncentrerede industrier. Der er også solide beviser for læring gennem eksport og læring gennem import af teknologi indlejret i halvfabrikata og fast realkapital. Endnu mere interessant er det, at vi fandt stærke beviser for læring gennem horisontal afsmitning via positive eksternaliteter fra udenlandske til indenlandske virksomheder.

Med regeringens ambitiøse plan for at ændre den økonomiske struktur til fordel for fremstillingsindustrien med de tilsvarende tilskyndelsesforanstaltninger på den ene side, og de ringe fremskridt for resultater i fremstillingsindustrien på den anden, kan man ane antydningen af, at der sker mulige afvigelser fra principper eller, at der er noget andet, som er gået galt. Generelt synes der at være mangler i indsatsen for at fremme læring på virksomhedsniveau, og for at skabe et mere befordrende miljø til at opbygge teknologiske kapaciteter. For dette formål viser afhandlingens samlede resultater vigtigheden af løbende forbedring af den interne kapacitet og læringskapacitet blandt lokale virksomheder. Politisk fokus på bevarelse af de allerede eksisterende effektive institutionelle støtter og styrkelse af de, som er svag, ville hjælpe med at bygge bro mellem mål og praksis. Resultaterne fra de empiriske analyser tyder på, at forbedringen af produktiviteten eller effektiviteten og kapitalintensiteten forbedrer virksomheders vækst og hjælper med at reducere sandsynligheden for afviklingen af virksomheder. Støtte til mere eksportorientering, en nemmere adgang til importerede halvfabrikata, og understøttelse af teknologisk opgradering kan forbedre indenlandske virksomheders læring og innovations-kapacitet. Dermed kan strukturændringer fremskynde. Selektiv tiltrækning af udenlandske investeringer til landets strategiske industrier og støtte af alle potentielle interaktioner med indenlandske virksomheder kunne spille en væsentlig rolle i opbygningen af lokale teknologiske kapaciteter, og kunne hjælpe med at realisere den ønskede strukturelle forandring.

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Special thanks to Margrethe Holm Anderson for her dedication and continuous efforts in coordinating every activity related to my PhD I can honestly say that without her intervention, this dissertation would not be as it is now. She has been an ever-present beacon of support, encouragement, and advice. Many thanks to Birgitte Gregersen, head of the department of Business and Management, for facilitating all the required paperwork and extending other related supports with other members of the team whenever I needed it.

I am deeply grateful to Bengt-Åke Lundvall, Esben Sloth Andersen, Birgitte Gregersen, Roman Jurowetzki, Daniel Hain, and other members of the IKE group who devoted their time to help me improve my thesis. Their comments and suggestions were truly helpful in shaping the structure and the quality of my dissertation to its current status. The interactions I had with them and my supervisors have been useful and influential on my general interest for research.

I would like to express my sincere thanks to Gro Stengaard Villumsen for her impressive support and assistance. I have always been able to turn to her when I have needed any help starting from the day I arrived at AAU as the first batch of Africalics visiting PhD students with other African fellows. She is truly kind and sociable. I will never forget the hospitality of her family and the fun we had with other friends when we visited her home. The gifts she and her families (Michael, Mikkel, and Jonas) presented to my newborn daughter have left everlasting memories in the hearts of my entire family.

Many thanks to my wife, Ajiba Mohammed, for her persistent support and encouragement toward satisfying my academic interests from day one, even when my curiosity led to incidents that were kind of hard to explain. Throughout most of my study periods, I left her alone in taking care of all the needs of our children (Sumeya, Aisha, Abdurrahman, and Leman). I am deeply grateful for her patience and strength to discharge all the responsibilities alone even when I was physically close to her but mentally far away. It would not have been possible to finish this dissertation without her help.

Finally, I know that there are many others who have helped me in one way or another during my study, but are not listed here. I thank all of them and will honor the help they gave me by repeating the kindness to others.

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ABOUT THE DISSERTATION

This dissertation has been submitted for assessment in partial fulfillment of the PhD degree. It is a paper based dissertation with three background chapters and three empirical chapters. The empirical chapters constitute the following standalone papers.

[1] Abdi Yuya Ahmad: Firm heterogeneity, growth performance and exit in the Ethiopian manufacturing sector: the role of Productivity and capital intensity; Paper to be presented on the 14th Globelics International Conference to be held in Bandung, Indonesia from 12 to 14 October 2016.

[2] Abdi Yuya Ahmad & Keun Lee (2016): Embodied technology transfer and learning by exporting in the Ethiopian manufacturing sector, *Innovation and Development*, DOI: 10.1080/2157930X.2016.1197330.

[3] Abdi Yuya Ahmad: The impact of Foreign Direct Investment on the Productivity and growth of Ethiopian firms. Paper presented on the 13th Globelics International Conference, Havana, Cuba, 23rd–25th September 2015.

The early version of this dissertation was also presented on the 12th Globelics International Conference and Published on the Conference Proceedings. The above conference papers are ready to be sent for publication on peer reviewed journals. With regard to the already published paper, a co-author statement has been submitted to the Faculty as per the thesis submission rule. The author holds the right to include the published paper in this dissertation as long as the dissertation is not to be published for commercial purpose and acknowledgement to the prior publication is given.

CHAPTER 1. INTRODUCTION

1.1. BACKGROUND AND JUSTIFICATION

Differences in aggregate productivity explain the largest proportion of the gap between countries' incomes (Easterly and Levine, 2001; Caselli, 2005). Growth theories (e.g., Romer, 1990; Aghion and Howitt, 1992; Grossman and Helpman, 1991) emphasize technological differences as the source of the productivity gap between the poor and the rich countries. Vast empirical evidence also shows that innovation and technological progress are the key factors behind long-term sustainable growth of both developed and developing countries (Fagerberg, Srholec, and Verspagen 2010). Due to the fact that poor countries lack the required capabilities to generate technologies, their aggregate productivity lags far behind rich countries. According to catch-up theory, however, being technologically backward for a country can be an opportunity, provided there are capabilities to tap frontier technologies made available through increased globalization. Accordingly they are likely to grow faster and catch-up with the rich countries (Gerschenkron, 1962; Abramovitz, 1986). This would happen if poor countries use the technologies they accessed to increase factor productivities, which in turn requires strong learning capability. From the system of innovation perspective, a country's development relies on the learning capability of individuals, organizations, and regions (Lundvall *et al.*, 2002). Learning facilitates changes in technology, institutions, structure, and attitude toward enhanced development in developing countries (Amsden, 1989; Kim, 1997; Johnson *et al.*, 2003).

Developing countries can also improve aggregate productivity through structural change by moving factors from less productive (traditional) to more productive (modern) sectors. McMillan and Rodrik (2011) indicated that the speed with which structural change moves is the key factor that differentiates successful countries from unsuccessful ones. They noted that countries that managed to eradicate poverty and got richer are those that were able to diversify away from agriculture and other traditional products. Countries in the sub–Saharan region have got most of their labor forces locked into the traditional sectors, that is, mainly agriculture. Moving resources out of these sectors would involve modernizing the sectors and diversifying toward the industrial sector that is yet to develop. However, it would be difficult to argue that structural transformation should lead to moving resources necessarily toward the industrial sector. It would also involve moving resources to the service sector, especially in the developed parts of the world. Nevertheless, the following arguments of structural economists are intuitively appealing for less developed countries.

Economic development through industrialization is one of the cornerstones that characterize the economic models in both old and new structural economics (Lin, 2011). In *New Structural Economics*, Lin (2011) expressed his strong belief in the coming of a golden age of industrialization in developing countries, including those in sub–Saharan Africa, in view of their high potential to host a rapid expansion of the industrial sectors and on the dynamic relocation of industries in a multi-polar growth world. Moreover, in his debate with Lin and Chang (2009) argued that "once you start thinking about growth, it is hard not to focus on the continuous industrial and technological upgrading that is characteristic of sustained economic growth." Likewise, Noman and Stiglitz (2012) suggested that development strategies in Africa need to focus on the learning, industrial, and technology (LIT) policy. Their main justification relates to the policy's perceived high potential in stimulating technological change and transforming production structure. The industrial sector, particularly manufacturing, is selected to lead economic transformation because of two major reasons. First, learning in the sector has more spillovers to the agricultural sector. Second, there is greater incentive to invest in R&D (innovation) in the industrial sector than any other sector.

Particularly, the argument in Cornwall (1977) and others that views "manufacturing as an engine of growth" supports the idea of structural economists. Similarly, Mazzarol (2013) emphasized the crucial importance of manufacturing in the economic growth of any country for its significantly higher multiplier effect compared to other sectors. They argue that manufacturing is technologically much more dynamic than other economic sectors and therefore should be regarded as a growth-inducing factor in its own right. However, the importance of the sector is greater for developing countries as the leading edge of modernization and skilled job creation, and as a fundamental source of various positive spillovers (Tybout, 2000), implying the need for increased investment in the manufacturing sector for sustainable development of the countries in the globalizing world (Wignaraja, 2003). It deserves special emphasis in landlocked and resource-scarce countries (Collier *et al.*, 2008) like Ethiopia, whose export relies mainly on primary agricultural produce. The development of the sector also helps improve the productivity of both resource-based and service sectors by virtue of its greater potential in creating up-stream and down-stream linkages. These facts have also been supported by empirical studies.

For example, as a lesson learnt from productivity research that used longitudinal data, Bartelsman and Doms (2000) documented that a large portion of aggregate productivity growth is attributable to resource reallocation. They also found that manufacturing is the most dynamic sector not only in its productivity but also in terms of intra-sectoral shifts in employment and output. Therefore, productivity of the manufacturing sector plays a crucial role in the process of structural change. This can justify the growing interest of developing countries in building a competitive manufacturing sector. However, the level of emphasis and achievements vary from country to country. In what follows, we will briefly examine the status and problems in the Ethiopian manufacturing sector.

1.1.1. WHY IS MANUFACTURING IMPORTANT FOR ETHIOPIA?

The manufacturing sector is at its infancy in the Ethiopian economy, as will be seen in the overview of the Ethiopian economy in Chapter 2 of this dissertation. However, it is considered a key strategic sector by the government and international organizations. The country's conditions also seem to justify the plausibility of arguments put forward in New Structural Economics by Lin (2011). The late Ethiopian prime minister aspired to build a state that fosters the emergence of dynamic competitive firms with the learning culture and capacity for continuous skill upgrading and innovation across all sectors (Zenawi, 2012). He believed that industrialization and technological innovation would enable the country to move out of subsistence production to more dynamic industrial production. This is evident in the country's first Growth and Transformation Plans (henceforth GTP I) and the second Growth and Transformation Plan(henceforth GTP II) that envisaged changing the economy from agriculture to industry based and achieving the levels of middle-income countries in 2025. Moreover, industrialization has been the core area of emphasis in the government policy since 1991, and various measures have been taken to develop the sector including creating conducive environment for foreign direct investment (FDI). Export-oriented sectors and foreign firms are offered special emphasis. This effort seems to pursue the argument that during the early stages of industrial development, a structural shift from agriculture to manufacturing benefits the poor. This relates to the fact that the manufacturing sector utilizes predominantly unskilled and semi-skilled labor in addition to its greater potential for aggregate productivity growth (World Bank, 2014).

However, the pace of structural change has failed to show meaningful progress. The two sectors—services and agriculture—have been the backbone of the economy. Labor has not shifted from less productive to higher productive sectors. The share of manufacturing in GDP has been stable over the last two decades, making only about 4.4% of GDP in 2014 with a growth rate of 11%, which is far below the 22% growth target of GTP I (World Bank, 2015). On the other hand, Dinh et al. (2012) reported that Ethiopia has unique desirable conditions that make it a good example for most countries in sub–Saharan African in terms of developing light manufacturing. Lack of the desired development in the manufacturing sector, despite the government's effort and favorable perception of investors toward the country's competitive advantage, remains an important question (World Bank, 2009) to be addressed.

Low productivity is the major cause for poor competitiveness of the Ethiopian manufacturing (World Bank, 2004, 2009, 2015; Subramanian and Matthijs, 2007). The World Bank (2009) indicated that poor productivity is related to structural and economic factors that jointly make the economy less responsive to incentives. Lack of experience and training, shortage of raw materials, financial constraints and of course lack of investment opportunities are among the major factors held accountable for low productivity (World Bank, 2009, 2015). Not only are firms inefficient in Ethiopia, but there also exists inefficient allocation of resources among firms, partly due to policy factors that shield incumbent firms from competition (World Bank, 2009), which characterizes manufacturing firms in Africa (Gelb et al., 2014).

According to Rodrik (2006), economic activity in low-income countries must be constrained either by very high cost of finance or low private returns to investment, or both. Poor development and inefficiencies in Ethiopia's private sector can be traced directly or indirectly to these factors. The situation can be diagnosed using Rodrik's (2006) diagnostic model presented in Figure 1.1. Corresponding to the case where the problem is due to low private returns, it would arise either due to low economic (social) returns or due to a large gap between social and private returns (low private appropriability). As will be seen in Chapter 2 of this thesis, low private investment in Ethiopia has been identified as a problem by the International Monetary Fund (IMF). However, it is difficult to identify which of these conditions more accurately characterize Ethiopia's economy, as Rodrik suggested. There is evidence of both low returns to economic activities on the one hand, and high cost of finance (World Bank, 2012, 2015) on the other.

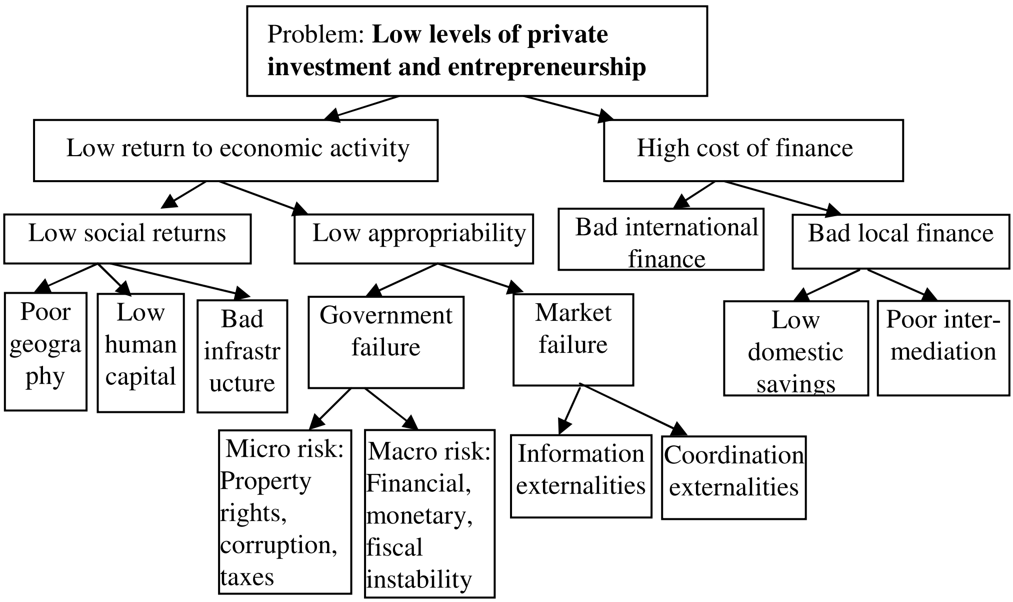

Figure 1.1 Rodrik's (2006) Growth Diagnostics

In his diagnostic analysis (Figure 1.1), Rodrik (2006) showed that in an economy where economic activity is constrained by low private returns, interest rates will be low, banks will be flush in liquidity, lenders will be chasing after borrowers, the current account will be near balance or in surplus, and entrepreneurs will tend to save in foreign banks than investing at home. Under this situation, foreign aid or remittances will largely finance consumption, housing, or capital flight. Ethiopia and El Salvador are the two examples mentioned by Rodrik, in this regard. In Figure 1.1, low private returns emanates either from low social returns or low private appropriability of those returns. Low social returns can be due to poor human capital, underdeveloped infrastructure, bad geography, or other similar reasons. When we look at the diagnostic signals, the fact that returns to education or skill premium are comparatively high in Ethiopia (World Bank, 2015) indicates the prevalence of poor human capital. Infrastructure is, obviously, among the binding constraint in Ethiopia when we look at very high transportation costs. Appropriability issues (i.e., a large gap between private and social returns) are also inevitable since there are many cases in which both the government and markets fail. Poor institutional environment and macroeconomic instability were shown to fuel the problem.

If the main culprit is market failure, it would be attributed to factors such as technological spillovers, coordination failures, and economic uncertainty, which relates to information asymmetries. Though Rodrik (2006) tended to associate Ethiopia's problem with low returns to economic activities, the current situation seems to also reflect the problem of finance, especially, with regard to international financing. The problem of domestic finance is more critical for small firms than large firms. Shortage of foreign exchange and ease of payment posed critical problems for large firms that are engaged in international trade (Oqubay, 2015) either by affecting overseas input sourcing or exporting products, or both. The above model has an important implication regarding the micro-foundation of growth constraints in low income countries like Ethiopia. Of course, the practical situations can be more complicated as Rodrik has also admitted, while indicating the need for a more detailed analysis.

According to AfDB (2014), the manufacturing sector in Ethiopia depends largely on imported raw materials while the use of local inputs has declined in recent years. This has resulted in two counteracting effects. On the positive side, firms that are able to access foreign inputs have managed to improve their product quality and their ability to sell internationally. On the other hand, it has weakened upstream linkages within the economy, making supplying firms vulnerable to world price fluctuations (AfDB, 2014). The entry of FDI has also increased over the last decade motivated mainly by the availability of cheap labor, abundance of raw materials, and government incentives, among others. The government has implemented FDI-friendly policy expecting an increased transfer of technology from foreign to domestic firms through a spillover effect. As is well documented in literatures, the spillover effect of FDI is never uniformly distributed among firms and sectors in recipient countries. The effect varies depending on the learning capabilities or absorptive capacities of domestic firms. Therefore, it is useful to understand the causes of differential learning capabilities and hence performance among firms.

1.1.2. THE IMPORTANCE OF LEARNING: OBJECTIVE SETTING

Raising the productivity of individual firms and shifting resources from less productive to high productive entities are the two major means of improving aggregate productivity. These cannot be realized without setting clear objectives and implementing robust strategies that would stimulate effective learning and innovations both at firm and country level. Firm-level learning and innovation improves the productivity of both production and R&D units of a firm (Yoon and Lee, 2009) by enhancing its capability. The neoclassical view that firms operate on the same production function was rendered obsolete by the evolutionary view that firms operate on different production functions owing to differences in their learning capabilities (Lall, 1992). Learning orientation is an organization-wide activity of creating and using knowledge and developing new technologies to enhance competitive advantage (Calantone et al., 2002). According to Lall (2000), learning capability includes not only the hardware and software components but also the corresponding technical and managerial skills to utilize these components. Learning is a means of accumulating the innovation capability of an organization (Calantone et al., 2002).

At country level, learning and innovation helps improve institutional support and design better policies environment that determine national technological capability, which is an important aspect of catching-up (Fagerberg, Srholec, and Verspagen, 2010). The importance of learning for developing countries has been manifested in terms of ‘infant industry argument’ (Dasgupta and Stiglitz, 1988) that justifies a protectionist policy aimed at building the competitiveness of domestic firms. The idea is to give domestic firms adequate time for learning and building their own capability by shielding them against competition from foreign firms. The argument seems to be grounded on the “learning-by-doing” hypothesis (Arrow, 1962) that associates productivity growth with experience.

The hypothesis was accompanied by Arrow’s explanation that followed the work of a Swedish scholar, Erik Lundberg, who introduced the “Horndal effect” to economics, based on his observation of a sustained productivity growth (over 15 years) of the Swedish steelworks at Horndal without any investment in the facility since its construction. Arrow (1962) argued that the sustained productivity growth at Horndal could “only be attributed to learning from experience.” Similarly, David (1973) examined the Horndal effect in a cotton textile mill called Lawrence Mill No. 2 that began operations in Lowell, Massachusetts, in 1834. He also found that labor productivity at the Mill increased at an average compounded rate of about 2% per annum between 1835 and1856 without any investment in new machinery. Like Arrow (1962), David (1973) argued that the productivity growth at Lawrence Mill No. 2 was the result of "learning-by-doing."

Later, Lazonick, and Brush (1985) reexamined the learning-by-doing hypothesis as an explanation of the productivity growth at Lawrence Mill No. 2 during its first two decades of operation. They found that productivity increased by an average compounded rate of 3.1% per annum. However, they questioned the adequacy of learning-by-doing as the only explanation for the observed changes in productivity without considering the possibility that the Horndal effect might have been caused by other factors. Particularly, they are critical of the implication of the hypothesis that the productive capabilities of an enterprise will necessarily improve with production experience.

According to Lazonick and Brush (1985), since the relation between inputs and output is partially social in nature, specific factors that motivate and condition the objectives and work efforts of different participants in the production process must be considered in explaining changes in productivity. Dasgupta and Stiglitz (1980) also showed that explicit allocation of resources to capital accumulation and research and development (R&D) capability is an important source of knowledge and productivity growth in addition to learning-by-doing. Apart from R&D-based innovation, other kinds of technologies also contribute significantly to the overall changes in technologically dynamic firms and industries in both developing and developed countries (Bell and Albu, 1999). These changes include improvements to existing production systems; and knowledge inputs drawn largely from existing stocks accompanied with continuous learning process.

With the emergence of global integration of production system, more types of learning have been identified alongside "learning-by-doing," such as "learning-by-using,""learning-by-exporting," "learning-by-importing," and "learning-by-interaction."In less-developed countries (LDCs), the extent to which firms exploit their internal capabilities and the capacity to access and absorb foreign technologies constitute the largest proportion of the variations in the performance of firms. In order to design proper strategies toward improving firm-level performance, in particular, and increasing aggregate productivity, in general, it is necessary to trace the main sources of differences in the performance of firms. In this respect, studies are virtually scarce in case of Ethiopia. Taking this into account and emphasizing that learning is a critical success factor in structural change, this dissertation examined the common forms of learning among the Ethiopian manufacturing firms in terms of their effects on performances.

Nevertheless, the dissertation provides a more elaborate dynamism of firm-level learning based on a complete framework in view of the relevant potential drivers of technological change in the Ethiopian manufacturing sector. It, particularly, deals with firm-level learning that stems from both internal and external sources focusing on the role of international trade and FDI in facilitating technology transfer and absorption of knowledge externalities.

The empirical chapters are organized according to a simplified conceptual framework given in Figure 1.2.

1.2. CONCEPTUAL FRAMEWORK

The basic conceptual framework of this dissertation derives from the theoretical grounds presented in Chapter 3 with reference to the relevant conditions in less developed countries. The framework in Figure 1.2 depicts the links between performance and learning from two sources broadly classified into internal and external. The internal sources would include learning by experience, social relation, resource allocation, and innovation, which in turn improves performance as the upper right arrow shows. External sources of knowledge consists of those accessed via exposure to export market, importing inputs, investment on fixed capital, and entry of foreign firms through FDI.

If we adopt the internal learning mechanism, there are two extreme ends of the learning spectrum distinguished by Bell and Albu (1999) in their cluster-based framework of analyzing firm-level learning. At one extreme, firms were shown to play a negligible role in either acquiring new knowledge from outside the cluster or generating such new knowledge themselves. If they do acquire new knowledge from outside the cluster, they do so “passively,” for instance, acquiring it as a “by-product'” from transactions such as selling products to customers perhaps including interaction with other firms and suppliers. Similarly, any new knowledge generation within the firm is likely to constitute limited extensions of existing knowledge arising “passively” as a result of learning-by-doing routine production tasks in line with the discussions presented in Section 1.1. These passive learning processes are believed to be executed through few specific organizational arrangements within firms designed explicitly to acquire or generate knowledge. Bell and Albu (1999) indicated that these organizational arrangements exist in some of the traditional industries clusters in developing countries.

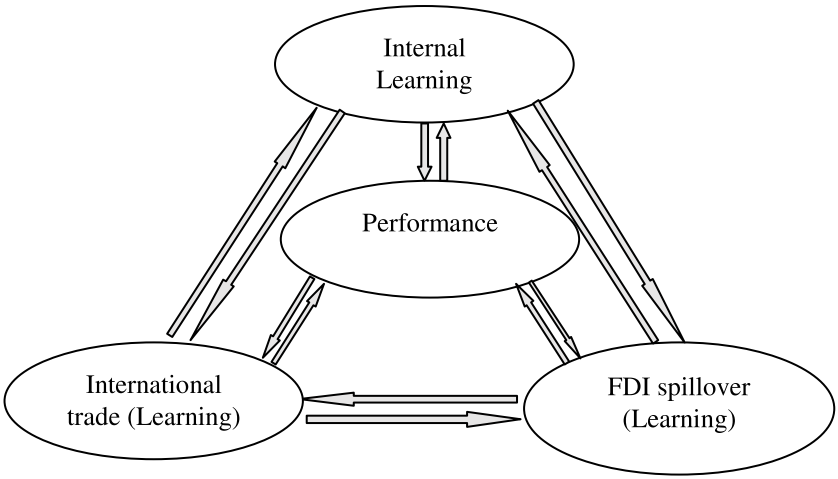

Figure 1.2 Conceptual framework

Source: Author's articulation

On the other extreme lie "active"' learning processes, which account for a relatively large proportion of the total flow of new knowledge that is either acquired by, or generated within, a cluster based on specific organizational structures within firms. For instance, at least to some degree, firms develop and create their own designs, and they do so on the basis of some degree of organizational specialization within the firm, be it an individual or "department"' entrusted with the specialized role of "designing" (Bell and Albu, 1999). The dominant role of "active" learning has been proved in case of Ethiopian manufacturing. A case study by Shimada (2013) on firms that participated in a government-initiated project called "kaizen" has proved to increase labor productivity by more than 50% but with heterogeneity of the effects among firms. Managers of successful companies, particularly, believe that the key to improve productivity and quality is to pursue a bottom-up approach at the manufacturing floor by building good management–employee relationships, appreciating communication with employees, and employee training (Shimada, 2013). This confirms the argument of Lazonick and Brush (1985) on the productivity effect of improved social relation, especially between managers and production workers, which can be seen as a specific form of organizational structure.

The arrows that show multi-way interconnections among the three sources of learning, which are generally categorized into internal and external sources, indicate the fact that the two sources are not mutually exclusive as one would strengthen the other. In other words, internally built learning capability of a firm would help the firm's capacity of using external knowledge and vice versa. Learning from international trade would also increase the absorptive capacity of domestic firms thereby increasing benefits from FDI spillover. These causal relationships can be articulated from correlations that would exist between organizational structures designed to acquire knowledge and those designed to generate knowledge as suggested by Bell and Albu (1999). Successful learning, whether originated within or outside a firm as facilitated by international trade and FDI, is shown to improve the performance of the firm.

The backward arrows from performance to the three sources of learning have been generated based on the findings of the three empirical chapters. The arrow running from performance to internal learning stems from the finding that high productivity increases firm growth. The finding that high productive firms self-select into exporting and importing indicates that greater performance can be seen as an incentive to open up more opportunity for firms to learn from external sources. This is indicated by the arrow that runs from performance to international trade. Similarly, due to the fact that we computed proxies of "absorptive capacity" based on productivity and efficiency, and the positive significant interaction between these proxies and FDI, implies higher performance improves firms' capacity to access and exploit knowledge from foreign firms. Thus, these findings can be taken as one of the contributions of the current study.

It is important to note also that internal learning and innovation are affected not only by external economic dynamics but also by the general institutional environment as depicted in Figure 3.2 of Chapter 3. Macroeconomic policies and supportive institutions determine the extent to which firms benefit from international trade and FDI (Bell and Albu, 1999). For instance, trade policies and supportive institutions such as financial and market institutions affect the ease of importing and exporting. The country's human resource base also determines the spillover effect of FDI on domestic firms. However, our interest here is limited to understanding the processes of learning and the dynamics that occur within localized production systems, which also reflects the general framework of this dissertation. It is also important to note the methodological difficulties in analyzing learning at the firm level. Some of the problems and the data used in the dissertation will be discussed in brief.

1.3. THE METHODOLOGICAL ISSUES

Methodologies applied to study firm-level learning vary in terms of the theoretical basis and the type of data used. Besides, there is quantitative and qualitative divide in the applied methodology with their respective pros and cons. The quantitative analysis is more common in the classical literatures where learning is treated as a blackbox. On the other hand, the qualitative approach is well known in analyzing systems of learning and innovation. The main concern of this section is to discuss how learning was treated and the data used.

1.3.1. MEASUREMENT OF LEARNING

In literatures, learning and innovation are closely related and improvement in innovation performance is the most common indicator of learning. However, the nature of the technological effort in most LDCs is quite different, and is based mainly on firm-level activities, which are not included in formal measures of innovation (Pietrobelli and Rabellotti, 2011). While the concept of learning is broad and generally common to any country, it is important to note the type of innovation referred to in LDCs' contexts in which diffusion plays a major role. The type of innovation in LDCs may include minor modifications in products, processes, and organizational routines. It is, therefore difficult to differentiate between innovation and diffusion in LDCs where firms engage in continuous modification and adaptation of foreign technologies to their own contexts (Fagerberg, Srholec and Verspagen 2010). Consequently, it is not easy to find more explicit measures of learning and innovation in LDCs than in developed countries.

Likewise, the data we used in this dissertation does not have any measure of innovation that would help measure learning more explicitly. Therefore, we answered the key empirical question of whether there is learning in manufacturing firms in terms of other measures of performance. In other words, similar to the traditional approaches, learning is indirectly measured in terms of the impacts of important firm characteristics on different firm-level performances. We used survival, growth, and productivity of individual firms to measure performance. Productivity is measured in terms of both labor and total factor productivity (TFP). Higher survival, growth, and productivity of firms are assumed to be the outcome of improved learning capabilities. Any factor that would improve performance will be interpreted as a source of learning. Unlike the traditional learning-curve approach, however, the main concern, here, is on what determines heterogeneities in firm performances. According to the evolutionary perspective and models presented in Chapter 3, these heterogeneities are the manifestation of the underlying differences in the firms' learning capabilities. A clear examination of such firm-specific effects requires appropriate data and method of analysis.

1.3.2. THE DATA USED

Both micro and macro data were used in this dissertation. Micro or firm-level data were mainly used for the empirical chapters, while macro data were utilized for the chapter on the country background aimed at supporting the research questions and shedding light on national-level technological capabilities. The macro data were also used to deflate the nominal values of some variables used in firm-level analyses. These data were obtained from different sources, including national and international institutions, were utilized to achieve the objectives of the chapter. Specifically, we used data from national institutions such as National Bank of Ethiopia (NBE), Ministry of Labor and Social Affairs (MoLSA), Central Statistical Agency (CSA), Ministry of Finance and Economic Development (MoFED), and international institutions such as International Monetary Fund (IMF), World Bank, United Nations, and African Development Bank (AfDB). Different related previous works and secondary materials were also widely consulted. The data were analyzed both qualitatively and quantitatively using descriptive statistics and graphs.

The microdata we have used for the empirical chapters of this dissertation are the most comprehensive firm-level data available for Ethiopia, which has been collected by the country's CSA through an annual survey of large and medium scale manufacturing (LMM) establishments. The survey is confined to those establishments that engage 10 persons and above and use power-driven machinery, and covers both public and private industries in all regions of the country. The survey has been the principal source of facts about the structure and function of the manufacturing industry in Ethiopia. The data have been gathered using structured questionnaire and face-to-face interviews to obtain detailed information on establishments' year of commencing operation; major industrial groups; ownership, number of persons engaged, and employees; wages and salaries; sex; paid-up capital; gross value of production; industrial and non-industrial costs; value added; operating surplus; quantity of production; raw materials consumed; fixed assets; market of final products; investment; production capacity; and other business related aspects. CSA applied different quality assurance strategies throughout the data collection process and engaged skilled professionals at different levels.

These data have been used for different operational and policy purposes by national and international institutions. For example, Ethiopia's Ministry of Finance and Economic Development uses the data in national income accounting and other important performance indicators such as employment and production capacities. In addition to their own data, the IMF, United Nations organizations (such as UNCTAD), and the World Bank also used the data for evaluating Ethiopia's progress in manufacturing and structural change and in monitoring the impacts of related development aids. Several researchers have also used the data to study various aspects of firm performance in Ethiopia. The studies include Söderbom (2011); Siba and Söderbom (2011); Bigsten, Gebreeyesus, Siba, and Söderbom (2011); Seyoum, Wu, and Yang (2015); Bigsten and Gebreeyesus (2009); Bigsten, Gebreeyesus, and Söderbom (2013); Shiferaw (2007 and 2008); and Gebreeyesus (2008).

Even though microdata are available starting from 1976 until recent years, we used the data spanning 2000–2011 to minimize the impact of variability in the data in terms of structural effects and variables. The main limitation of the data is that there are no variables that directly measure innovation, R&D, and the quality of human capital of establishments. These variables would have enabled us to measure firm-level learning more explicitly than the way it is done in this dissertation. The data were analyzed mainly using a dynamic panel data econometric called System GMM (Generalized Method of Moments) developed by Blundell and Bond (1998, 2000) to take the potential problems arising from weak exogeneity of the independent variables into account. In addition to this, we applied matching techniques and panel probit regression where necessary. Summaries of the analyses and contributions of the chapters are presented in the following sections respectively.

1.4. CHAPTER SUMMARIES

Apart from the current chapter, this dissertation constitutes five chapters. Chapters 2 and 3 are background chapters, the former being the background of Ethiopia's economy while the latter is discusses theoretical and methodological backgrounds. Chapters 4, 5, and 6 are independent empirical papers with their respective theoretical and methodological sections. The following subsection provides chapter summaries.

Chapter 2: Overview of the Ethiopian Economy and the Industrial Sector

Chapter 2 provides an overview of the background of the Ethiopian economy, the industrial policy and practices based on available literatures, and secondary data from both national and international sources. The chapter is mainly aimed at helping readers gain basic information on the status of the Ethiopian economy and backing the justification for undertaking this study. The chapter is particularly important, as it comprises important factors that contribute to the national technological capability that relates to the process of building firm-level technological capability. These capabilities are conditioned by national technological capabilities (NTC). We are particularly interested in the three-pronged approach developed in Lall (1992), involving the interplay of capabilities, incentives, and institutions, as a useful way of organizing the numerous factors that influence NTC in developing countries. Capabilities can be grouped under three broad headings: physical investment, human capital, and technological effort. Institutions that most directly affect industrial capabilities include legal framework supporting industrial activity, property rights, industrial institutions, training institutions; and technology institutions. Incentives are broadly classified as macroeconomic incentives, incentives from competition, and incentives from factor markets.

Therefore, aggregate measures such as aggregate productivity (both at macro and sector levels); different measures of national account such as gross domestic product (GDP), gross domestic income (GDI), per capita GDP, etc.; employment; economic stability; development financing; human development; competitiveness in international trade; structural change; and other related indicators are included in the chapter.

The general picture derived from the chapter is that, Ethiopia has an ambitious plan of industrializing the economy since the last two decades. Many efforts have been taken, particularly, to increase the role of manufacturing in the economy. Despite the absolute increase in the number of manufacturing firms, however, the contribution of the manufacturing has remained below 5%. The high emphasis placed on export-oriented manufacturing resulted in dismal success. The sector is dominated by traditional industries related to natural resources. There seem to be different structural and institutional constraints in developing the sector to the level aspired by the government. Under these circumstances, the impact of firm-level efforts and learning has been recognized as the key to success in the manufacturing sector.

Chapter 3: Theoretical Framework and Methodology

Chapter 3 provides details of the theoretical and methodological foundations of the dissertation. The chapter begins with growth theories from both orthodox and heterodox camps that are believed to be linked with and support the current firm-level analysis. Most importantly, endogenous growth theories (e.g., Romer, 1990; Aghion and Howitt, 1992) share important aspects with evolutionary theory in two main ways. First, both emphasize that the traditional factors of production such as labor or capital are subject to diminishing returns, while investment in knowledge has increasing returns due to positive externalities and knowledge spillovers between economic actors. Endogenous growth theory argues that developed countries not only are the source of most R&D efforts and scientific research, but they also benefit more from investment in knowledge than less developed countries. Thus, it helps us understand the process of divergence in per capita incomes between rich and poor countries in the global economy (Szirmai et al., 2011). Second, in spite of very different features, endogenous growth models possess an implicit or explicit Schumpeterian engine (innovation) from a quite different angle (Dosi et al., 2010).

Chapter 3 continues by explaining why industrialization in general, and development of the manufacturing sector in particular, is important for LDCs in view of the pivotal role of technology in economic performance. It will show the interconnections among international trade, technological capability building, industrialization, and structural change with their implications for firm-level learning. A more general theoretical model of firm-level learning has been developed based on theories and earlier models proposed for less-developed countries. The chapter concludes with an elaboration of methodologies applied in terms of both theoretical and empirical models of analyzing firm-level learning.

The theories and related empirical evidence suggest that the main source of knowledge in the process of building local technological capability in LDCs heavily relies on imported technologies. Successful adoption and adaptation of these technologies, however, depend on the internal capability of domestic firms. Therefore, the evolutionary theory of Nelson and Winter (1982) can best support the conceptual framework of the empirical chapters that shows links between firm-level learning and performance in view of the dynamic environment.

Chapter 4: Firm Heterogeneity, Growth Performance, and Exit in the Ethiopian Manufacturing Sector: The Role of Productivity and Capital Intensity

Firm growth and survival are crucial for the development of the manufacturing sector in countries at the early stage of industrialization. A steady growth in firm productivity with eventual addition to its size can be interpreted as the "learning-by-doing" effect (Coad, 2007), that is, learning-by-using and learning-by-interacting. On the other hand, if firms do not show any growth over time despite some improvement in their productivity, it would mean that there is no efficiency gain or resources that have been freed from the gain are merely absorbed as organizational slack. The indicator of success for firms, therefore, is translating what has been learnt into better growth and profit (Coad, 2007). In view of the "missing middle" phenomena (Sleuwaegen and Goedhuys, 2002) of the African manufacturing sector, the majority of firms in the continent are far from success. This phenomenon emerged due to the fact that small firms remain small without growing into the next level leading to underrepresentation of medium firms in Africa. Some of the reasons for this problem are financial constraints, transport costs, limited infrastructure, and a lack of suitable management and technical skills (Sleuwaegen and Goedhuys, 2002). Moreover, literatures show that small and young firms face higher exit rates than large and old firms.

Therefore, learning appears to be a crucial factor for better growth and survival of firms in line with the theoretical basis of industrial dynamics elaborated in Chapter 3. Chapter 4 is, thus, relegated to analyze these aspects while taking into account firms' heterogeneity in terms of different firm and sector characteristics. Nevertheless, the analyses were made to focus on two main objectives that relate to learning. The first was to investigate the role of firm size, productivity, and capital intensity on firm growth while controlling for other important variables. The growth impacts of size and productivity correspond to the passive learning models. Capital intensity was taken as a key variable of interest, mainly, due to its confounding effect on age-growth nexus (Thompson, 2010) and the assumption that it would represent capital vintage, which would in turn enhance firm growth by improving labor productivity. The second objective was to examine the impact of productivity and market concentration on firm exit. Unlike other similar studies, the chapter went on further to show empirically whether increased market concentration entails more exit risk to small and less efficient firms as it has often been discussed in evolutionary theory.

In view of the above framework and Coad's (2007) interpretation of complementarities between growth and productivity as well as the passive learning1 model of Jovanovic (1982), Chapter 4 represents the internal learning block shown at the top of Figure 1.2. Besides, focus was drawn on the role of productivity and market concentration on firm exit in order to elicit the impact of passive learning on market structure, whereby incumbent firms strengthen their position while least performing firms would be forced to exit (Dasgupta and Stiglitz, 1988; Thompson, 2010), which characterizes the evolutionary process. In general, Chapter 4 is an empirical representation of the industrial dynamics in which selection makes the central point of economic evolution. The theoretical basis of industrial dynamics can be seen in Section 3.3 of Chapter 3. It is also embedded in the theoretical model of firm-level learning (Figure 3.2). Though the focus is on internal learning, other factors outside the firm have their own effect and hence controlled for according to the model. All the hypotheses set to be tested in this chapter are based on the evolutionary explanation of Dosi and Nelson (2010) that heterogeneities in growth and survival of firms depend on their differential learning capabilities. The empirical analyses were undertaken using descriptive and regression methods. Growth equations were estimated using the extended system Generalized Method of Moments introduced by Blundel and Bond (1998) on both sales and employment growths. To analyze determinants of firm exit, panel probit regression was applied.

Results indicate negative significant effects of both firm size and age on sales growth. This confirms the existence of passive learning phenomena by Jovanovich (1982) in Ethiopian manufacturing firms. However, age was considered a control variable while placing more importance on the role of capital intensity. Firms with high TFP have significantly higher growth, in terms of both sales and job, than firms with low TFP. The result appeared to be robust also upon estimating the equations separately for surviving firms only and for all firms in the data. Similarly, more capital-intensive firms appeared to have shown significantly higher growth rates than firms with lower capital intensity. However, the result is more robust in the case of sales growth than employment growth. Among the control variables, export and foreign ownership show positive significant effect on both sales and job growths. The positive sign of export dummy indicates evidence of "learning-by-exporting."The positive impact of foreign ownership confirms the assumption that foreign firms are more capable of growth than domestic firms.

High productivity and greater capital intensity help not only firm growth, but also increase the survival probability of firms. Firms in a more concentrated sector are more likely to be competed out. This appears to be strange in view of the common expectation that high competition increases exit rate rather than less competition.

[1] Passive learning is said to prevail when firms managed to adjust their expected efficiency as they learn their actual costs (Jovanovic, 1982). It is often interpreted also as learning-by-doing though it would go beyond this (Thompson, 2010).

However, it suggests a unique characteristic of the Ethiopian manufacturing sector in which many small firms coexist with few large firms. In relation to this, it is important to explicitly identify which firms face higher exit rates. Literatures show that small firms are the potential victims of exit. In addition to small firms, we argued that less efficient firms also exit earlier than more efficient firms in concentrated sectors, taking further the suggestion by Jovanovic (1982).

The finding shows that there is no any significant interaction between concentration index and firm size in determining exit. This suggests that firm size does not affect exit probability in the concentrated sector as opposed to the hypothesis. The interaction between market concentration and dummy for high efficiency gap, however, turned out to be positive and significant, indicating high exit probability among less efficient firms in concentrated markets. In other words, the finding shows that more efficient firms are more likely to survive in concentrated sectors regardless of their size. The impact of high efficiency gap can also be interpreted as the impact of technological inferiority on exit. In view of the theoretical underpinnings, the finding shows that firm heterogeneity in terms of productivity, efficiency and capital intensity imply the relevance of the technological capability approach of Lall (1992) and the evolutionary theory of Nelson and Winter (1982).

Unlike previous similar works, Chapter 4 of this thesis presents a more comprehensive analysis of growth and exit using recent data and robust tools of analysis. Its specific major contribution can be seen in two aspects. First, unlike the mixed results in past studies, the fact that we found strong positive effect of productivity and capital intensity on firms' growth (in both sales and job) is a valuable addition to the existing knowledge. Second, it has objectively identified which firms are more vulnerable to exit in more concentrated sectors. It indicated that firms whose efficiency is farther from that of a frontier firm in a sector are the ones to die out sooner due to selection effect. By doing so, we proved that the suggestion by Shiferaw (2008) about which firms exit in a more concentrated sector cannot be supported empirically. In contrast with his expectation, size plays a general role for exit but not specific in concentrated sectors.

Finally, the policy implications of the finding suggest the importance of making the maximum possible efforts o improve firm-level productivity, capital intensity, and efficiency to accelerate firm growth and survival. This would also help reduce the high exit rate of firms in more concentrated sectors. The positive effect of high capital intensity implies that more capital-intensive firms grow better than labor-intensive firms. This stands in contrast with the government's intention to capitalize on the labor-intensive sector. Moreover, the evidence that firms in Ethiopia are reported to be more capital intensive than expected (World Bank, 2015) strengthens the concern from the policy perspective. Nevertheless, we need to be cautious when making a final generalization due to the fact that high capital–labor ratio would reflect the quality (technology) of capital inputs or vintages rather than quantity.

Chapter 5: Embodied Technology Transfer, and Learning-by-Exporting in the Ethiopian Manufacturing Sector

As will be seen in Chapter 3, international trade constitutes an important building block in the theoretical modeling of firm-level learning in less developed countries (LDCs).Literatures provide the microfoundation of the role of trade on economic performance in terms of export participation and improved accessibility of high quality products for firms. In terms of the first, widened export opportunities and tense competition give rise to reallocation of resources from less to more productive firms and hence boost aggregate productivity gains (Melitz, 2003; Melitz and Ottaviano, 2008). Exporting would also increase firm productivity (Pavcnik, 2002), which could be related to learning through interaction with foreign customers and increased competition. Trade improves access to cheap and high-quality imported inputs to firms in developing countries, thereby increasing firms' productivity (Grossman and Helpman, 1991; Amiti and Konings, 2007; Kugler and Verhoogen 2009). Generally, participation in international trade may increase the awareness of domestic agents about promising products, services, or technologies, and stimulate capability formation in enterprises (Fagerberg, Lundvall, and Srholec, 2016).

Trade and growth models (e.g., Rivera-Batiz and Romer, 1991; Grossman and Helpman, 1991) show both static and dynamic benefits to developing countries, from improved access to new products or new varieties of existing products. An increased productivity level of firms as a result of using imported inputs represents a static gain from trade. If the imported inputs lead to reduced cost of innovation and hence stimulate the creation of new products, it means that trade generates dynamic gains for firms in importing countries. Both static and dynamic benefits can be shown to relate with the impact of technologies transferred through trade. Due to the costly, risky, and path-dependency nature of R&D-based creation of new technologies, the essential sources of innovation and learning for LDCs are knowledge and technologies imported from abroad (Fu, Pietrobelli, and Soete, 2011).

In view of this, increasing globalization and technological progress can be seen as an opportunity for LDCs. However, evidence so far indicates that poor countries are the most adversely affected in face of the growing competition following globalization (Lin, 2011). This is because poor countries produce products with less technological content (Lall, 2003). For instance, countries in sub–Saharan Africa (SSA) have achieved the least from international trade in transforming their economies despite their potential, particularly, in light manufacturing (World Bank, 2012). This also relates to their negligible role in the global value chain with the exception of South Africa (Subramanian and Matthijs, 2007). They are, particularly, constrained by lack of competitiveness in terms of price, speed-to-market, labor productivity, flexibility, and product quality (Subramanian and Matthijs, 2007).

The evolutionary perspective of industrial development requires that firms utilize inputs both from internal and external sources in the process of learning and innovation. Due to the fact that conditions in LDCs forced them to rely on foreign technologies for building their technological capabilities, participation in international trade and global value chain (GVC) is crucial. However, empirical evidence shows that participation in GVC itself requires adequate technological capability (Fagerberg, Lundvall, and Srholec, 2016). Therefore, the policies and institutions affecting international flows of equipment and services, human capital, and foreign investments, and the GVC matter for LDCs (Pietrobelli and Rabellotti, 2011).

This implies that firms that participate in international trade either through exporting, importing, or two-way trade are expected to perform better than those limited to the domestic market. Country-specific empirical evidence in SSA, in this regard, are very limited. A few studies that are available show mixed results. In the Ethiopian manufacturing sector, Bigsten and Gebreeyesus (2009) found strong evidence of “learning-by-exporting” while recent studies (e.g., Siba and Söderbom, 2011) reported to have failed to confirm the evidence. On the other hand, there is no other study that has dealt with imbedded technology transfer in Ethiopia. The only study with a related implication is that of Bigsten et al. (2013), which showed that reduction in import tariff increases the productivity of input-importing firms.

The fact that exporting and importing by a firm are likely to be interrelated and each has its own effect on productivity, recent literatures suggest the merit of analyzing the two together (Kugler and Verhoogen, 2008, 2009; Aristei et al., 2012). There has been no study that takes this fact into account in the Ethiopian context. Therefore, Chapter 5 is devoted to fill this empirical gap. We assumed that participation in international trade explains a significant proportion of productivity gains in the Ethiopian manufacturing firms following exporting and importing of goods. The chapter further extends the analysis by treating the impact of investment in new fixed capital and examining the differences in the impact of importing and investment in new capital between exporters and non-exporters.

The gains from using imported inputs and investment in new fixed capital are interpreted as the outcome of embedded technology transfer. A case study by UNCTAD (2011) indicates that a lot of technology transfer to pharmaceutical companies in Ethiopia has been embedded in ordinary trade and investment transactions instead of pursuing ways subject to technology transfer regulations. Thus, examining the impact of exporting and embedded technology transfer, through imported inputs and new capital goods, on firm performance is a vital issue to see the role of trade in building technological capabilities toward Ethiopia’s industrial development. Therefore, we can say that Chapter 5 is concerned with testing two hypotheses: learning-by-importing and learning-by-exporting.

The same data over the same period were used to test the hypotheses in both Chapter 4 and Chapter 5. However, the dependent variables and the modeling strategies (to some extent) are different. The dependent variables (performance measures) are labor productivity (LabP), total factor productivity (TFP), and TFP catch-up. Data were analyzed using econometrics and matching techniques. The first technique follows a two-step estimation where TFP was estimated first using the semi-parametric approach of Levinsohn and Petrin (2003). LabP was computed by dividing gross value added and the number of permanent employees of a firm. The computed TFP, LabP, and TFP catch-up were used as dependent variables in the second step estimation using system GMM. Recent literatures suggest including both importing and exporting simultaneously while analyzing the impact of trade on performance of firms. We extended this by including investment in fixed capital, separately, into estimating equations as it can be related to both import and export. We controlled for the impact of other important variables such as size, age, ownership, and market concentration due to their potential confounding effects. The empirical modeling follows studies that are interested in identifying factors that determine heterogeneities in firm-level productivity as reviewed in Nelson (1981).

Results from the analyses indicate that manufacturing firms in Ethiopia are benefiting a lot from trade in terms of all the three measures of performance (LabP, TFP, and TFP catch-up) but in different degrees. If we divide trade into export and import, the latter has more inclusive benefit as most of the firms in Ethiopia use imported inputs although with varying intensities. Likewise, the benefit of exporting is limited to exporters, which account nothing more than 5% of the total manufacturing firms but with high potential gainsfor the rest of the economy. The impact of investment in new capital good is also related to trade as most of the goods are imported either directly by the firms or other dealers. From an evolutionary theory perspective, heterogeneities in the degree of innovativeness and production efficiencies are attributed to the varying distributions of capital equipment of different vintages, idiosyncratic capabilities (or lack of them), mistake-ridden learning, and path-dependent adaptation (Dosi and Nelson, 2010), which are assumed to be affected by international trade.

Exporting, using greater proportion of imported inputs, and investing in new capital goods were found to significantly improve firm performance in terms of all three indicators LabP, TFP, and TFP catch-up. The impact of import is higher on LabP, while that of new capital goods is greater for TFP and TFP catch-up. The fact that imported inputs have greater effect on labor productivity has a useful policy implication for Ethiopia where low labor productivity is among the major causes for the poor competitiveness of the manufacturing sector (World Bank, 2015). Exporting has a strong positive effect on all the three measures of performance. Moreover, the positive effect of imported inputs and new capital goods on TFP is higher for exporting firms than non-exporters, implying better learning capability among exporters in using embodied technology.

The propensity score matching (PSM) technique applied to probe the potential impacts of “self-selection” also validates the regression results with slight differences between LabP and TFP. In terms of LabP, imported inputs, new capital goods and export have strong positive effects. In case of TFP, however, only new capital goods and exporting appeared to have a positive productivity effect. The positive effect of importing seems to reflect the selection effect rather than the productivity (TFP) effect. The finding implies that improvement in TFP drives firms into increased use of imported inputs, which in turn raises the productivity of labor. The statistically stronger effect of new capital goods on TFP and TFP catch-up in case of regression and the PSM results indicate that capital goods have greater potential in embodied technology transfer.

Given the Ethiopian government’s ambition to industrialize its economy, it is crucial to improve the country’s status in international trade by building the competitiveness of potential export entrants and providing institutionalized assistance for these firms in searching markets abroad. It is also important to help current exporters improve their export intensity if the country's current dismal export proportion has to be changed. The result also suggests the need for facilitating more access to imported inputs and helping firms upgrade their capital goods so that they realize both static gains, in terms of productivity and product quality, and dynamic gain in terms of building technological capability. One of the practical steps to be taken in the Ethiopian context is to improve firms’ access to finance and foreign exchange. Then the country would increase both the static and dynamic gains from trade, in particular, and accelerate the pace of structural change in Ethiopia, in general.

Chapter 6: The Impact of FDI on the Productivity and Growth of Ethiopian firms

In addition to international trade, the most important driver of international technology transfer is FDI (Keller, 2001; Blomström and Kokko, 2002). It is well known that transnational companies and firms in industrialized countries contribute the largest share of global R&D efforts and breakthrough innovations. Therefore, they produce, own, and control most of the world’s advanced technologies. When such advanced overseas companies invest or setup affiliates in developing countries, the affiliates access some of the technologies owned by the parent firm. These technologies can be transferred to domestic firms if they have vertical linkages with foreign affiliates giving rise to what is called vertical spillover. However, the technology may also leak to the surrounding economy through external effects or “spillovers” that raise the level of human capital in the host country and create productivity increases in local firms (Blomström and Kokko, 2002). If this spillover occurs within the same sector, it is called horizontal spillover.

Most empirical findings confirm the occurrence of vertical spillovers rather than horizontal spillovers (Blomström and Kokko, 1998; Görg and Greenaway, 2004;

Crespo and Fontoura, 2007; Smeets, 2008). It is also clearer in literatures how knowledge or technologies transfer vertically from multinational companies (MNCs) to domestic affiliates. MNCs may force their local affiliates to increase their managerial efforts, or to adopt some of the marketing techniques and technologies used by MNCs, or use better quality intermediates (Blomström and Kokko, 1998, 2002). On the other hand, there seems to be more difficulty in explaining the mechanism in which developing host country firms may benefit from MNCs through horizontal spillovers. Imitation, skills acquisition, competition, and export orientation are among the most commonly discussed channels (Görg and Greenaway, 2004).

In view of LDCs, FDI is considered one of the crucial drivers of technological change in industrial development (Lall, 2006), which is also apparent from the theoretical models presented in Chapter 3 of this dissertation. Despite this fact, productivity and technology spillovers from FDI are not automatic (Fu, Pietrobelli, and Soete, 2011). Literatures show that human capital of the recipient country plays a key but complex role in determining the benefit earned from FDI. For instance, Blomström and Kokko (2002) indicated that the host country's human capital determines the quantity of FDI it can attract and the absorptive capacity of firms in that country. Moreover, it determines the type of technology that would come with FDI, which has a direct implication with the corresponding spillover effect. On the other hand, FDI inflows develop a potential for spillovers of knowledge to the local labor force. If the human capital base or the absorptive capacity of a host country is poor, FDI is likely to bring simpler technologies that contribute only marginally to local learning and skill development.

Studies in this regard are very much limited in Ethiopia. The only exception, to our knowledge, is Seyoum et al. (2015) who analyzed the impact of Chinese investment on Ethiopia from an outward perspective and found a positive productivity effect of Chinese FDI on Ethiopian firms with high absorptive capacity. However, their finding casts doubt about the robustness of the results primarily due to truncation of foreign firms considering only investment from China. Second, due to the fact that they used cross-sectional data, the findings would face similar critics on the early studies that used cross-sectional data. As it has been reviewed by Görg and Strobl (2001) and Görg and Greenway (2004), almost all studies that used cross-sectional data found positive horizontal spillover while this was hardly confirmed by studies that used panel data.

Therefore, Chapter 6 presents the empirical analysis of horizontal spillover effects from all FDIs in the Ethiopian manufacturing sector using firm-level panel data over 2002–2011. The chapter goes beyond only examining the effect of FDI on productivity, unlike previous studies. We extended the analysis by including the effect of FDI on domestic firms' growth, and computed FDI at different levels of sectoral aggregation. Moreover, it examines differences in the impact of FDI on domestic firms with varying relative productivity and relative efficiency. This was on the basis that firms' relative performance reflects their capacity to absorb external technology.FDI was computed using the share of foreign firms' current paid-up capital in the total current paid-up capital in four- and two-digit industries. We used TFP to measure productivity, which was estimated using Levinsohn and Petrin's (2003) method. Firm growth was estimated using the growth rate of domestic firms' sales. Firm heterogeneity in terms of size, age, sector, and ownership was also taken into account in the estimation process. The main analysis was conducted using the system GMM of Blundell and Bond (1998) similar to Chapter 5. In this chapter, the hypotheses to be tested relate to assessing the learning effect of FDI on domestic firms.

Results of the analysis indicate that domestic firms benefit from the presence of foreign firms in their respective sectors. Firms in sectors with higher presence of FDI have shown significantly higher TFP and growth rates, suggesting the evidence of a horizontal spillover effect. The results also suggest that spillover effect is higher for firms with high relative productivity and low technology gap. This implies that firms with high relative productivity and/or low efficiency gap have higher absorptive capacity. When we look at results from estimation based on two-digit and four-digit industrial classifications, the spillover effect varies with the two measures of performances. The productivity effects of FDI are positive and robust in both levels of sectoral classification. However, the growth effect of FDI is positive and significant only in four-digit sectors while it appears to be negative in two-digit sectors. This indicates the possibility of two opposing impact of FDI on domestic firms depending on the concentration of FDI. When FDI is computed at four-digit International Standard Industrial Classification (ISIC), concentration is lower due to less number of foreign firms compared to concentration of FDI at two digit sector. Accordingly, firms in four-digit sector revealed better growth rate indicating the dominance of a positive learning effect over the negative competition effect of FDI.

On the other hand, there appeared to be negative growth effect of FDI in the two-digit sector mainly due to high concentration of FDI. In view of what is normally expected, high concentration of FDI is supposed to be associated with greater positive externality. However, there is also the risk of increased competition with domestic firms in terms of market share and resources. This is inevitable, as Ethiopia, like other African countries, is dominated by market-seeking and resource-seeking type of FDI (Chen et al., 2015). The cumulative effect of FDI depends on the relative weight of the two counteracting effects. Therefore, the negative growth effect of FDI on firms in two-digit sector indicates the dominance of negative competition effect over the positive learning effect. Nevertheless, in view of the strict definition of horizontal FDI spillover at the most disaggregated level of industrial classification (Smeets, 2008), it is possible to generalize the overall finding as supporting evidence of positive horizontal FDI spillover effect in the Ethiopian manufacturing sector. However, the finding also suggests differential impact of the spillover effect on firms depending on their absorptive capacities. This strengthens the argument in evolutionary theory that only prepared and agile firms can effectively tap into any form of knowledge externalities.

Like any other studies that applied econometric techniques, the current study could not explicitly elaborate on the actual channels of horizontal FDI spillover. Some case studies (Geda and Gebremeskel, 2010; Lemma et al., 2014; Chen et al., 2015; Brautigamet al., n.a.) show that foreign firms helped domestic firms by easing supply bottlenecks, training workers, and improving managerial competencies. There is also a high chance of spillover through workers' mobility and demonstration effect in the Ethiopian pharmaceutical industry due to the existence of multiple joint ventures, better skilled labor, and a strong local pharmaceutical manufacturers' association (UNCTAD, 2011).

1.5. COMBINED CONTRIBUTIONS OF THE DISSERTATION

The overall picture of this dissertation can be seen as the effort made to analyze firm-level learning on the basis of macroeconomic conditions and a framework developed from diverse theories. The theoretical basis of the dissertation was founded on the combination of literatures from both orthodox and heterodox families. Of course, it would be difficult to entirely disentangle the two broad categories of economic theories in practical applications. For instance, the concept of TFP has its root in the neo-classical growth model. But it was later contextualized by relaxing some of the restrictive assumptions in a way that firm-level heterogeneities can be accommodated in pursuit of better performance, which characterizes the evolutionary perspective of economic dynamism. Studies on firm growth appear to use different "theories of the firm" ranging from economics to managerial theories assuming different objectives of the firms. Productivity studies are also classified into neoclassical and evolutionary categories. Studies that follow neoclassical approaches are concerned with aggregate productivity assuming a "representative firm" paradigm and imposing other restrictive assumptions that do not make much sense (Baily et al., 1992; Bernard et al., 2003). Those in the latter categories recognize firm-level heterogeneities and seek to examine what causes these heterogeneities.

The empirical chapters of this dissertation analyze learning in terms of both growth and productivity based on the evolutionary theory assuming widespread heterogeneity among firms within an industry. In the three empirical chapters, we have tried to connect results with the theoretical framework shown in Chapter 3 taking into account the potential interplay among firm characteristics and strategic behaviors on the one hand and the alternative sources of learning and innovation on the other. The findings from the three empirical chapters indicate heterogeneities in firm performances depending on different firm and sectoral characteristics in line with the underlying theory. The first empirical chapter deals with firm growth and survival, which are considered crucial in the industrial dynamics of any country. This chapter is aimed at eliciting internal learning process in terms of the growth and survival effects of different firm characteristics such as productivity, capital intensity, and differences in the age-size distribution, among others. The impact of market selection was also addressed in terms of firm survival and exit while allowing for differences in industrial structures. Given the importance of firm growth and survival in the early stage of industrialization and the finding in Chapter 4 that productivity is the first most important determinant of both growth and survival, it is helpful to examine what constitutes differences in the productivity of firms. Hence, the fact that Chapters 5 and 6 emphasize on the productivity impact of learning from external sources, there exist logical links among the empirical chapters. Therefore, it is possible to view the combined contributions of the dissertation in terms of both empirical and theoretical contributions.

Empirical Contributions

The general empirical contribution can be observed in the additional information this dissertation has brought to the scarce literature in the African context. In this regard, the findings would play its part in explaining the apparently mixed results in the region corresponding to each of the empirical chapters and different variables of interest. The findings from the empirical chapters indicate heterogeneities in firms' capabilities to exploit different sources of knowledge.

Results from Chapter 4 indicate that small firms grow faster than larger firms in terms of both sales and employment. Firms with higher TFP and higher capital intensity also demonstrated faster growth and higher survival probabilities. The unique contribution of the chapter includes the finding that firms in more concentrated sectors face higher exit probability, implying greater impact of market selection in such sectors as opposed to what is theoretically expected. This effect is associated with the passive learning phenomena as indicated by Thompson (2010). The other major contribution of this chapter is that it has identified the differential effects of size and efficiency on survival of firms in more concentrated sectors. We found that firm size does not affect exit in more concentrated sectors, in contrast to what is theoretically assumed, while it has significant positive effect when all sectors are taken into account. Besides, it was found that firms with relatively lower efficiency gap have greater opportunity to survive in concentrated sectors. This has an important implication about the working of "creative destruction." It suggests that even a small firm with higher efficiency can have a better opportunity to survive than a large but inefficient firm in more concentrated sectors.

From Chapter 5, it appeared that higher use of imported inputs, higher investment in fixed capital and exporting significantly increase both productivity and productivity catch-up of the firms. The results also suggest the importance of simultaneously testing the hypotheses of "learning-by-exporting" and "learning-by-importing" along with embodied technology transfer. We have shown that exporting not only increases productivity and productivity catch-up, but also increases the opportunity of learning through technologies embodied in imported inputs and fixed capitals. Using higher proportion of imported raw materials appeared to play a greater role in improving labor productivity, while fixed capitals appeared to serve as a stronger means of transferring embodied technologies as compared to imported inputs.

According to the results from Chapter 6, firms in sectors where there are more foreign affiliates revealed higher growth and productivity than firms in sectors with lesser foreign firms. This indicates robust evidence of horizontal spillover effect, which appears to be a rare incidence in most empirical works. Domestic firms with low technology gap or high "absorptive capacity" were found to reap greater benefits from FDI in terms of both productivity and growth. However, the findings with respect to the effect on growth showed differences when FDI variable is computed based on different levels of industrial classification. In two-digit industries, the impact of FDI was found to be negative and significant as opposed to the positive and significant impact on firms in four-digit sectors. This implies that the negative competition effect overweighs the positive learning effect of FDI in two-digit sectors. To the best of our knowledge, this is the first ever evidence in FDI spillover literature.

With respect to the overall framework set in Chapter 3 and the major variables of interest, the results in the three empirical chapters are in agreement. This is evident from the fact that the combined results helped us improve the initial conceptual framework to the one presented in Figure 1.2, which fits into the general models depicted in Figures 3.1 and 3.2. The strong positive effect of TFP on firm growth in Chapter 4 and the fact that larger firms possess higher TFP according to results from Chapters 5 and 6 indicate persistency of positive correlation between firm growth and productivity. This is one way of explaining passive learning that is conditioned by internal organizational efforts. The strong positive growth effect of capital intensity observed in Chapter 4 can be associated with the impact of embodied technology in line with the discussions in Chapter 5. Though considered as control, the positive significant effect of exporting on firm growth (both in Chapters 4 and 6) strengthens the main findings of learning-by-exporting in Chapter 5. Moreover, the negative significant interaction effect between market concentration and efficiency (Chapter 4) in determining firm exit implies the importance of learning in industrial development. Similarly, the positive interaction between FDI and relative productivity and efficiency in determining productivity (Chapter 6) stresses the need for building firm capability or absorptive capacity toward facilitating knowledge spillover.

In all the three chapters, important firm characteristics such as age, size, ownership, market concentration, and sector were commonly included in all regressions. However, these variables appeared to have varying effects on different measures of performance. For instance, it is worth noting the differences in the effects of firm age, size, and concentration on growth, survival, and productivity. In Chapter 4, firm size and age were found to have negative effects on sales growth, which is often seen as evidence of passive learning. However, these variables appeared to be inversely related to the probability of firm exit. In contrast to the effects on firm growth, firm age and size revealed positive significant effect on productivity and TFP catch-up. These effects would be interpreted, respectively, as evidence of learning-by-experience and the role of scale economies. Market concentration was found to play a positive significant role in boosting firm productivity (Chapters 5 and 6). However, firms in more concentrated industries did not show any significant difference in terms of growth yet with higher probability of exit than firms in less concentrated industries (Chapter 4).

Theoretical Contributions

The theoretical contribution of this thesis relates to the development of a complete framework for analyzing firm-level learning that can be applied to broader contexts in SSA countries. In order to build this framework, we used the general enterprise-level learning model developed by Wignaraja (2003), the SSA version of the "innovation system" framework developed by Lall and Pietrobelli (2005), and theories that follow the "technological capability" approach of industrial development. The relevance of the theoretical framework has been corroborated by the empirical findings that helped us modify not only the general theoretical framework of firm-level learning but also the prior conceptual framework of the dissertation.

The initial conceptual framework was set based on well-established theoretical grounds that indicate a one-way relationship between performance and learning. However, from the findings of the three empirical chapters, we found the importance of performance in augmenting firms' capability to learn. This confirms the path-dependency of learning in line with the evolutionary theory and the already-existing framework on the national system of learning and innovation. Accordingly, we updated the conceptual framework of this dissertation (Figure 1.2) in such a way it shows two-way relationships between learning and performance.

Specifically, the addition of the backward arrows in the figure can be traced to the empirical results from the respective chapters. First, the arrow from performance to internal learning stems from the findings in Chapter 4where high productivity was found to have strong positive effect on firm growth, which is not the case in most empirical studies (Coad, 2009). Second, based on the findings from the matching techniques (Chapter 5) that high productive firms self-select into exporting and importing, one can see the fact that greater performance can stimulate firms' interest to enter into the international market, thereby opening better opportunities to learn from external sources. This is indicated by the arrow that runs from performance to international trade. Finally, as we computed proxies of "absorptive capacity" from productivity and efficiency, which turned to have positive significant interaction with FDI in determining growth and productivity, it implied that higher performance improves firms' capacity to access and exploit knowledge externalities from foreign firms.

In summary, this dissertation provided a comprehensive framework of analyzing firm-level learning in SSA contexts given the underlying constraints in data and the institutional environment. It indicated more relevant channels of learning, which can also be seen as the potential sources of innovation for manufacturing firms in Ethiopia. The results imply the need for coordinating managerial efforts and incentive mechanisms toward building the capability of local firms. Improved managerial efforts can increase firm performance by designing better use of productive resources and strengthening organizational capabilities. Incentive measures would include provision of institutionalized capacity building, improved access to finance, providing all kinds of services that would reduce transaction costs, exerting more effort in creating a better platform for transferring foreign technologies, etc. In fact, most of these measures are claimed to have been put in place as discussed in Chapter 2. However, the effects have continued to be invisible in terms of performance. According to the current findings, there is an opportunity to make a difference if firms can do their best to learn even in the absence of incentive mechanisms.

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CHAPTER 2. OVERVIEW OF THE ETHIOPIAN ECONOMY AND THE INDUSTRIAL SECTOR

2.1. INTRODUCTION

In the process of economic development, there are natural links among the economic activities at the micro, meso, and macro levels. At the micro level, the extent to which firms perform in terms of profitability, growth, innovation, efficiency, and productivity determine the performance of an industry to which the firms belong. Proper allocation of resource among industries or sectors (meso level), in turn, would help individual firms exploit their potential capacities toward better performance both at the micro and meso level. Improved sectoral productivities lead to growth in aggregate productivity of a given country and hence to an increase in national income. Better macroeconomic performance also creates conducive conditions for individual firms to carry out their businesses and stimulate the market in both demand and supply sides. Therefore, it is important to consider these interconnections in providing a comprehensive picture of the development process. The current chapter is relegated to this task but limited only to macro and "meso" aspects that are believed to be relevant in justifying and assisting a better understanding of the microeconomic analysis that forms the core of this dissertation.

The basic idea behind firm-level learning toward promoting industrialization in developing countries is to build local firm-level technological capabilities. These capabilities are conditioned by national technological capabilities (NTC). We are particularly interested in the three-pronged approach developed in Lall (1992), involving the interplay of capabilities, incentives, and institutions, as a useful way of organizing the numerous factors that influence NTC in developing countries. Capabilities can be grouped under three broad headings: physical investment, human capital, and technological effort. Institutions that most directly affect industrial capabilities include legal framework-supporting industrial activity, property rights, industrial institutions, training institutions, and technology institutions. Incentives are broadly classified as macroeconomic incentives, incentives from competition, and incentives from factor markets. In other words, this chapter is concerned with national and sectoral aspects as a basis for the theoretical framework set in the next chapter (Chapter 3) and the microeconomic analyses presented in the three consecutive empirical chapters.

At this juncture, it is important to note the differences in using the word "performance" as it appears in all the chapters. In the empirical chapters, it refers to firm-level measures such as growth, survival, productivity, and innovation. In the current chapter, performance refers to aggregate measures such as aggregate productivity (both at macro and sector levels); different measures of national account such as GDP (gross domestic product), GDI (gross domestic income), per capita GDP, etc.; employment; economic stability; development financing; human development; competitiveness in international trade; structural transformation; and other related indicators.

Therefore, data from different sources, including national and international institutions, were utilized to achieve the objectives of the chapter. Specifically, we used data from national institutions such as the National Bank of Ethiopia (NBE), Ministry of Labor and Social Affairs (MoLSA), Central Statistical Agency (CSA), Ministry of Finance and Economic Development (MoFED), and international institutions such as IMF, World Bank, United Nations, and African Development Bank (AfDB). Different related previous works and secondary materials were also widely consulted. The data were analyzed both qualitatively and quantitatively using descriptive statistics and graphs.

This chapter begins with a brief policy background as a basis for the subsequent sections, which present the country's status in terms of selected macroeconomic and development indicators. Next, it examines the structure of Ethiopia's economy and its pace of structural change. This is followed by discussions on the structure of the industrial sector and efforts toward implementing industrialization policies. Then, the specific performance of the country's manufacturing sector is elaborated with reference to the performance of selected countries in the eastern Africa region, in particular, and sub–Saharan African nations, in general. The final section concludes the chapter.

2.2. THE POLICY BACKGROUND

Ethiopia is among the poorest countries in the world with over 95 million inhabitants. Agriculture is the main contributor to the national economy and the mainstay for the majority of Ethiopians. However, the sector is dependent on rainfall and it is subsistent. This dependence has made the country's GDP follow rainfall trend which has even a negative multiplier effect in the subsequent years (Geda, 2001), that is, the impact of drought in a given year persists by certain proportion over the years. In addition to this, conflicts and politically driven radical changes in policy destructed the country's opportunity to progress. The country underwent different economic reforms as a result of changes in regime. In order to examine the economic reforms and their corresponding performance, it would be helpful to have a quick look at the three consecutive regimes that ruled the country over the last several decades.

These regimes include the Hailesilasse regime (before 1974), the Derge regime (1974–1991), and the Ethiopian People's Revolutionary Front (EPRDF), which is currently in power. The Hailesilasse regime was the imperial regime that followed market-oriented economic policy. Love (1979) indicated that even though the economy was market oriented during this regime, the skewed distribution of income and the land tenure system had negative consequences both on the economic wellbeing and political stability. In 1972/3, Ethiopia ranked as the world's poorest country with a per capita GNP of 80 USD. The annual growth rate of per capita GNP was about 2.8% slightly higher than Sudan and Somalia but below Kenya (3.6%) and Tanzania (7.1%).

The Derge regime came into power by overthrowing the imperial regime through military coup. The regime followed a centralized economic system in which the state was the decision maker in the overall economic activities. There were limitations to private holding of wealth and restrictions to engage in diverse businesses. During this period, the growth rate for GDP was about 2.3 with a negative per capita growth (–0.4). Rainfall variability, the war with neighboring Somalia, and the civil war in the northern part of Ethiopia worsened the country's economic problems (Geda, 2001).

In 1991, the Derge regime was toppled by EPRDF in an armed struggle. Soon after, the country witnessed a radical shift in economic policy into market orientation paving way for private businesses. Like other African countries, the new Ethiopian government launched a structural adjustment program (SAP) imposed by the IMF as a pre-condition for access to loans. Privatization policy was introduced and marketing boards and cooperatives were dismantled following SAP. The aims of privatization included improving firm operations, ensuring efficient allocation of resources, reducing government spending, building the capital market, stimulating FDI inflows, and facilitating technology and skill transfers. However, Ethiopia appeared to have deviated from the IMF's prescription in implementing SAP by retaining ownership of "strategic" companies such as telecommunication, production, and distribution of electric power, railway, banks, and some of the large manufacturing enterprises. Under the current "developmental–state" ideology, the government continued to invest in building sugar factories, fertilizer, and metal engineering companies. Moreover, Ethiopia has not yet opened its financial sector for foreign firms.

Considering that Ethiopia is among the poorest countries in the world, the main development objective of the new government was to eradicate poverty in a relatively short period of time. To achieve this, the government has tried to design and implement broad-based development policies that would stimulate economic growth and bring about equitable distribution of the benefits thereof. The Agricultural Development-Led Industrialization (ADLI) strategy was introduced as a comprehensive framework of economic transformation. The strategy was entrusted to boost the productivity of Ethiopia's small-holder agricultural sector based on which capital would be generated in order to invest in downstream industrial activity. The industrial sector in turn was expected to create markets for agricultural produce in the form of raw material and consumption goods for industrial workers. Following ADLI, the government designed and implemented three development plans in the past two decades.

The first was a three-year plan called Sustainable Development and Poverty Reduction Program (SDPRP), which was executed in the years 2002/03–2004/05 (FDRE, 2002). It was in this plan that the government formulated a more comprehensive industrial development policy that elaborated on the industrialization aspects of ADLI and underlined the need for focusing on selected sectors. At the center of industrial development was boosting incentives for developmental capitalist so that they could operate globally competent businesses. The government was determined to maintain macroeconomic stability and strengthen supporting institutions to correct market failures. Sectors that were identified for direct government support include textiles and clothing, meat and leather, agro processing, construction and SMEs (World Bank, 2009).

The second was the five-year (2005/06–2009/10) millennium development goals (MDG)-based plan: the Plan for Accelerated and Sustained Development to End Poverty (PASDEP) (UNCT, 2011). Compared to the SDPRP, this second strategy paid more extensive focus on private sector development. The plan targeted an annual growth rate of 11.5% for the industrial sector, to raise the sector's share in overall GDP from 13.6% in 2004/05 to 16.5% by 2009/10 (World Bank, 2009). This target was not realized, as there was only marginal improvement to 14.3% in 2010 (World Bank, 2013).

The third was the first Growth and Transformation Plan (GTP-1) that has been in effect between 2010/11 and 2014/15. The GTP envisaged achieving an average economic growth target of 11.2% over 2010/11–2014/15 and realizing the MDGs(FDRE, 2010). Raising agricultural productivity and scaling-up infrastructure and human capital development are among the key pillars. The implementation of GTP-1 was better organized than the previous plans. However, at the end of the period, the actual performances appeared to have fallen short of the initial targets. The GDP growth was about 10% on average, which is lower than the target. The growth performance of the agricultural sector (6.6%) was far lower than the targeted growth of 8.6%. The only exception was the industrial sector, which exceeded the average growth target of 20% in 2012/13 by more than 4%. However, the role of manufacturing within the industrial sector remained unchanged. In general, the performances of the industrial sector and the service sector were close to the anticipated target during the five-year implementation plan.

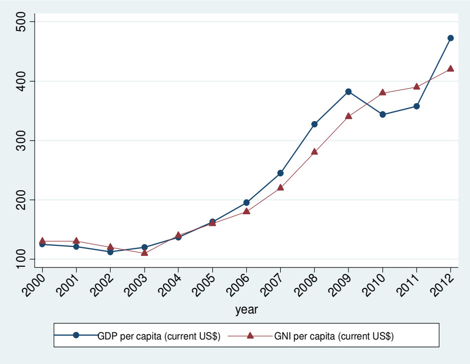
Assuming the above ground on the overall economy and their implications for firm-level performance, the following subsections provide an overview of the dynamics of the Ethiopian economy in terms of some major indicators. In most cases, Ethiopia is compared either with the sub–Saharan countries, in general, or with some specific neighboring countries.

2.3. THE MACROECONOMIC SITUATIONS

2.3.1. GDP AND ITS GROWTH

Accelerating growth in GDP and eradicating poverty are the prime objectives of the Ethiopian government. The authorities vowed to achieve the ambitious objective of becoming a middle-income country by 2025. According to recent data from the World Development Indicator (WDI) (World Bank, 2015a), the country belongs to low-income groups with the gross national income (GNI) of USD 44.5 billion (129.6 in PPP) and GNI per capita of 470 USD (1,380 USD at PPP) in 2013. If we examine the trend in GDP per capita and GNI per capita over the 2000–2012 periods, there was a consistent rise in both (Figure 2.1a). In 2000, the GDP per capita and GNI per capita at current USD were about 125 and 130 respectively. At the end of 2012, these figures reached about 472 and 420, respectively. This can be seen from the following graph (Figure 2.1).

(a)



(b)

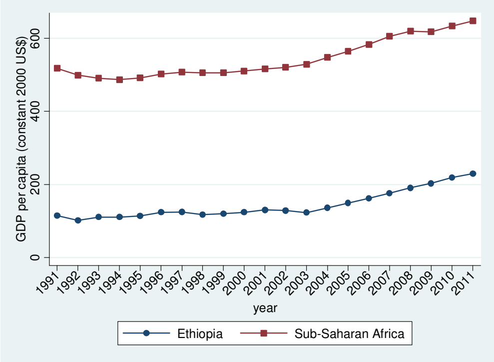


Figure 2.1 GDP and GNI per capita

Source: Computed from ADI

However, Ethiopia's GDP per capita is far lower than the average value in sub–Saharan Africa (SSA), as can be seen in Figure 2.1(b). In 1991, the real GDP per capita of Ethiopia was about USD 115 while the average for SSA was about USD

518. At the end of 2011, Ethiopia's real GDP per capita reached double of its 1991 value (230) whereas the average of SSA stood at USD 647 with only marginal improvement. This indicates that Ethiopia was performing excellently in terms of growth. This is evident using graphs (Figure 2.2) depicting the trends in growth.

(a) (b)

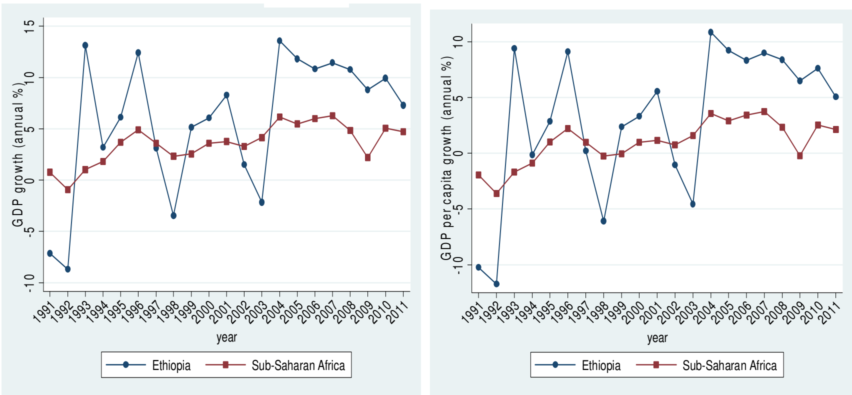


Figure 2.2 Growth in GDP and GDP per capita

Source: Computed from ADI

Figure 2.2 shows that growth in GDP and GDP per capita of Ethiopia were at their worst just after the market reform. Following the sudden changes in the economy, however, GDP growth had begun to register double-digit value in 1993 with growth in GDP per capita of almost 10%. Both GDP and per capita GDP growths had been swinging between negative and positive values before 2004. They turned out to be negative in 1991, 1992, 1998, and 2003. Unlike that of Ethiopia, growth in SSA was more stable, ranging between 0 and 5%. However, the growth rates were relatively higher than that of SSA except during the periods of negative growth. The average growth is higher in Ethiopia than the average growth in SSA region.

The following table (Table 2.1) shows the average GDP growths over selected periods. The average annual growth during 1991–2011 was about 5.8%, while that of SSA was about 3.6%. Similarly, the average annual growth in GDP per capita of Ethiopia was 3.04% while that of SSA was only about 0.99%. The difference had been bigger over recent years. If we look at the average in 2004–2011, Ethiopia's GDP growth (10.56) was twice larger than the average in SSA (5.10). During the same period, the growth in GDP per capita of Ethiopia had grown to 8.10%, which is more than three times higher than its growth (2.56%) in SSA. This difference remained high in 2012–2013 as indicated by the World Bank (2015a). Accordingly, the average annual GDP growth was 10.5%, which is far higher than the average in

SSA (4.1%). Growth in real GDP and GDP per capita in the same period were about 9% and 7.5%, respectively.

	GDP growth (%)		GDP per capita growth (%)	
Over	Ethiopia	SSA	Ethiopia	SSA
1991–2011	5.82	3.59	3.04	0.99
2004–2011	10.56	5.10	8.10	2.56
2012–2013	10.5	4.1	7.5	1.4

Table 2.1 Average growths in GDP and GDP per capita
Source: Computed from ADI and World Bank (2015a)

In terms of GDP composition, a World Fact book estimate in 2013 indicates that 83.1% of the country's GDP constitutes household consumption, while government consumption accounted for 8.6%. Investment in fixed capital, exports of goods and services, and imports of goods and services accounted for 26%, 11.5%, and –29.3% of GDP. From the point of view of development, distribution of national income is an important indicator worth discussing along with GDP. Under high income inequality, the indicated household consumption would be attributed only to some rich parts of a society. Table 2.2 shows that the Gini index of Ethiopia in 2010 was about 33 while that of the three neighboring nations in Africa—Kenya in 2005, Tanzania in 2011, and Uganda in 2012—were about 49, 38, and 42, respectively. Given the differences in the years of comparison, income inequality in Ethiopia seemed to be better than the three countries.

Country	GINI index (World Bank estimate)	year
Ethiopia	33.17	2010
Kenya	48.51	2005
Tanzania	37.78	2011
Uganda	42.37	2012

Table 2.2 GINI index
Source: WDI database

2.3.2. EMPLOYMENT AND UNEMPLOYMENT

Ethiopia is the second populous country in Africa, following Nigeria, with an estimated population of about 97 million in 2014 (World Bank, 2015a).It is the largest country in East Africa with over 80 different ethnic groups. Figure 2.3 shows that about 81% the people reside in rural areas close to that of Uganda. Regarding the age distribution of the population, Ethiopia is not different from the three east African countries of Kenya, Tanzania, and Uganda, as can be seen in Figure 2.3. The working age population (15–64 years) in Ethiopia and Kenya accounts for about 55% of their total inhabitants. Around 42% of Ethiopia's population constitutes children aged 0–14 years, which is similar to Kenya but lower than Tanzania and Uganda. Old age population accounted only for about 3.5%, which was slightly higher than the three countries. This age distribution shows that Ethiopia is endowed with high labor inputs and high potential entrants to the labor market.

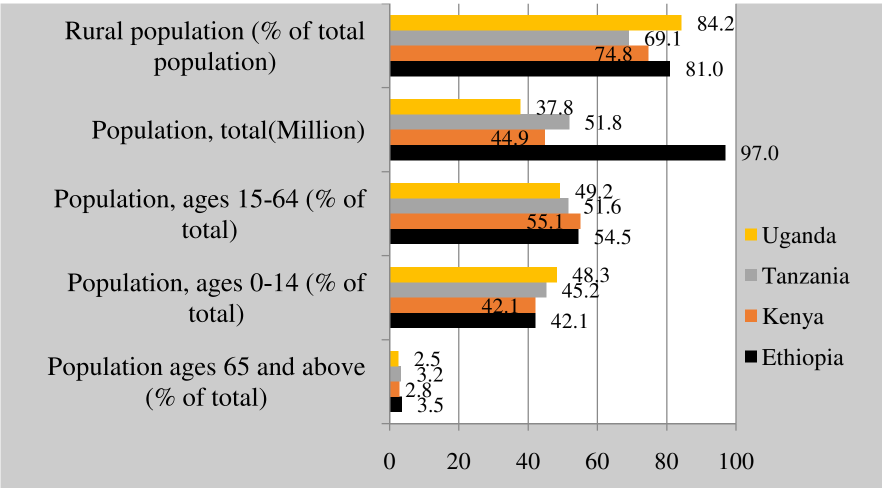


Figure 2.3 Ethiopia's population in 2014
Source: WDI database

Conditions in the labor market are among the important indicators of a given country’s economy. The employment and unemployment rates as the main indicators represent the job-creating capacity of the economy. In Ethiopia, strong investment-led economic growth delivered improvements in the employment conditions in the urban areas (IMF, 2013). In order to see the dynamics in the labor market, we use labor force participation rates (LFPR[2]), employment-to-population ratio,[3] and unemployment rates. For Ethiopia, the working-age population includes persons aged 15 and over (MoLSA, 2013), similar to the World Bank’s definition in the ADI. Thus, we used LFPR computed in ADI database for population aged 15 and above. The trends in LFPR and employment-to-population ratio are shown in Figure 2.4.

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[2]LFPR is defined as the ratio of the labor force (employed plus unemployed) to the working-age population, expressed in percentage.

[3]Employment-to-population ratio (expressed in terms of percentage) is defined as the proportion of an economy’s working-age population that is employed.

Figure 2.4 shows that Ethiopia's LFPR (panel a) and employment-to-population (panel b) were far higher than the averages of SSA in 1991–2011, implying higher employment creation capacity of the country for its working-age population.

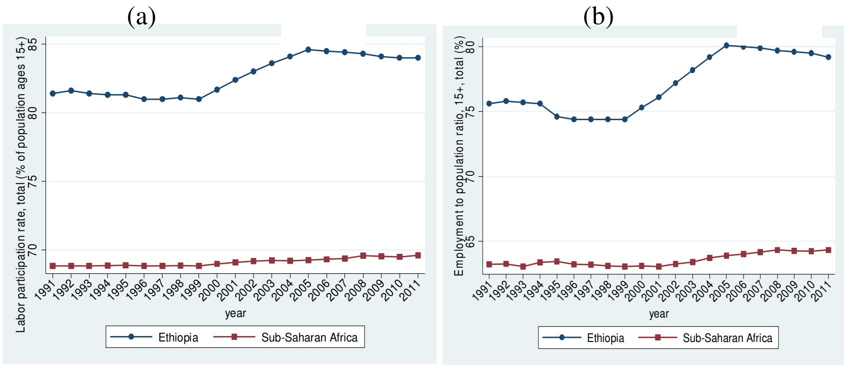

Figure 2.4 Labor participation rate and employment-to-population
Source: Computed from ADI

Similarly, LFPR was absolutely higher than 80% in Ethiopia while that of SSA was under 70%. Employment-to-population ratio was almost above 75% in Ethiopia, while it was below 65% in the three comparator countries in the region. For Ethiopia both have increased after 2000. In earlier years, the majority of the people were employed in the informal sector.[4] For instance, the proportion of working population in the informal sector was as high as 72.8% in 1999. This figure has dramatically declined in later years reaching 33.3% in 2010 (MoLSA, 2013), perhaps due to the government's effort to formalize businesses and the tendency of growth in formal private businesses.

[4] Employment in the informal economy is defined as all jobs in informal sector enterprises or all persons who, during a given reference period, were employed in at least one informal enterprise, irrespective of their status in employment and whether it was their main job or a secondary job (MoLSA, 2013).

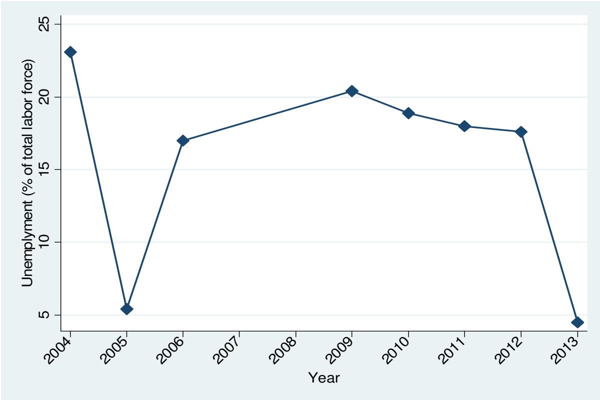

Figure 2.5 Unemployment rate

There seems to be an irregularity regarding employment, which could be due to seasonality or data issues in terms of both availability and quality. MoLSA (2013) indicated that Ethiopia's national unemployment rate was about 3% in 1994, which dramatically increased in 1999 (8%). The figure declined to about 5% in 2005. Data from the Word Bank's development indicator also depicts a similar irregularity. The following graph (Figure 2.5) shows the trends in unemployment rate in the 2004–2013 periods. The sudden decline of unemployment rate from about 23% in 2004 to about 5% in 2005, which again jumped to 17% in 2006 is a great surprise. Between 2006 and 2012, the average unemployment rate was about 18%, which appears to be more amenable given the missing data for 2007 and 2008. In 2013, the lowest unemployment rate (about 4%) was registered again showing a sudden drop from about 17%for unknown reasons.

2.3.3. INFLATION

One of the objectives of the Ethiopian government is to keep inflation at its single digit. However, there have been incidents of high inflation levels over the last decade. For instance during 2006/07–2010/11, when Ethiopia's economy registered impressive double-digit economic growth, inflation reached record high levels. MoFED (2012a) indicated that the general annual inflation rates were 15.8%, 25.3%, and 36.4% during the years 2006/07, 2007/08, and 2008/09, respectively (Table 2.3). The figures in the table show that inflation has been mainly driven by the food components in the general price until 2008/09. In 2009/10 and 2010/11, the non-food components dominate.

Year	2003 /04	2004 /05	2005 /06	2006 /07	2007 /08	2008 /09	2009 /10	2010 /11
Overall	7.3%	6.1%	10.6%	15.8%	25.3%	36.4%	2.8%	18.1%
Food	11.5%	7.4%	13.0%	17.5%	34.9%	44.3%	-5.4%	15.7%
Non-food	2.2%	4.4%	7.1%	13.5%	12.5%	23.7%	18.2%	21.8%

Table 2.3 Trends in overall countrywide food and non-food inflation
Source: *MoFED, 2012a* (Note: The figures show 12-month moving average 2003/04-2010/11)

It is important to note the difference in the inflation rate data from Ethiopia and those from IMF and the World Bank. Data from the later institutions are higher than the Ethiopian government data. For instance, IMF (2013) reported that in 2011, Ethiopia experienced the worst inflation recorded in Africa and the second worst in the world (next to Belarus) which was 38.1% on a year-to-year basis. Similarly, the world development indicator (WDI) database shows that the annual growth in price levels at the end of 2008 and 2011 were 44.39% and 33.2%, respectively, as can be seen in Figure 2.6. As it is partly observed in this figure, the IMF (2013) had anticipated a two-digit inflation rate during the first GTP period (2010–2015). The Ethiopian government claimed to have reduced the inflation rate to 2.8% in 2009/10 (Table 2.3) through its tight fiscal policy. This is far below the rate reported in WDI, which was about 8% in 2010.

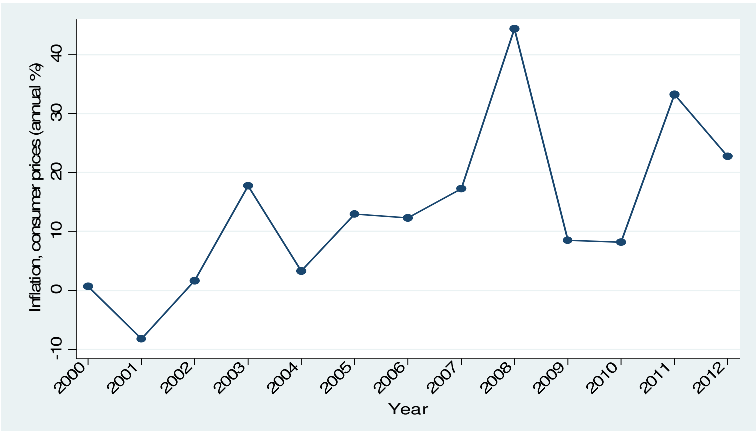

Figure 2.6 Trends in the inflation rate
Source: Computed from WDI databases

The bottom line is that Ethiopia experienced severe challenges from inflationary pressure. What makes this problem difficult for the government to address is that there is no clear knowledge about its sources. While admitting this difficulty, MoFED's (2012a) report highlighted some of the supply side and demand side factors behind the problem. There is a tendency to associate part of the problem with foreign sources in the report. As opposed to this, the IMF (2013) demonstrated that domestic rather than foreign factors were more important determinants of Ethiopia's recent inflation.

2.3.4. INTERNATIONAL TRADE

It is known that trade has a substantial effect on the performance of a given economy. Less developed countries, like Ethiopia, heavily depend on import of capital goods to help transform their traditional economic sectors. On the other hand, they contribute insignificant amounts to the export market. The fact that they export primary commodities makes them vulnerable to shocks in the commodity markets and exposes them to unfavorable terms of trade. Ethiopia's major export commodities include coffee, oilseeds, leather, and leather products, pulses, flowers, and khat[5] among others (Table 2.4). There are, of course, changes in the contribution of commodities over time as can be seen in Table 2.4. According to the World Fact Book estimates, China was the major partner in commodity export taking 13%of Ethiopia's export in 2012. During the same year, Germany, United States, Belgium, and Saudi Arabia received 10.8%, 8%, 7.7%, and 7.6%, respectively.

	2005 /06	2006 /07	2007/08	2008/09	2009/10	2010/11	Growth rates (%)
Commodities							05/06-10/11
Coffee	354.3	424.2	524.5	375.9	528.3	841.8	18.9
Oilseeds	211.4	187.4	218.8	356.1	358.5	326.6	9.1
Leather and leather products	75.0	89.6	99.2	75.3	56.4	103.8	6.7
Pulses	37.0	70.3	143.6	90.7	130.1	137.9	30.1
Meat & meat products	18.5	15.5	20.9	26.6	34.0	63.3	27.8
Fruits and vegetables	13.2	16.2	12.8	12.1	31.5	31.5	19.0
Flowers	21.8	63.6	111.8	130.7	170.2	175.3	51.8
Gold	64.7	97.0	78.8	97.8	281.4	417.3	45.2
Live animals	27.6	36.8	40.9	52.7	90.7	147.9	39.9
Khat	89.1	92.8	108.3	138.7	209.5	238.3	21.8
Beeswax	1.4	1.8	1.8	1.6	1.6	1.8	4.3
Others	86.4	90.0	104.4	89.8	110.9	217.3	20.3
Total	1000.3	1185.1	1465.7	1447.9	2003.1	2702.7	22.0

Table 2.4 Value of major exports (value in million USD)
Source: NBE

[5] A mild stimulant plant (called "chat" in local language) which is grown, as a cash crop, mainly in the Eastern and partly in the southern parts of Ethiopia

In terms of growth, the overall performance of merchandize exports has been favorable over 2005/06 and 2010/11.Coffee, gold, flowers, live animals, and pulses have significantly contributed to the growth of total exports between 2005/06 and 2010/11. The overall growth in merchandize export has been 22%. In value terms, total exports increased from 1 billion USD in 2005/06 to 2.7 billion in 2010/11. Similarly, the export of goods and services as a percent of GDP has grown in 2000–2005 (Figure 2.7). However, it declined between 2006 and 2009, which could be related to the global financial crisis. After this period, growth in export has improved.

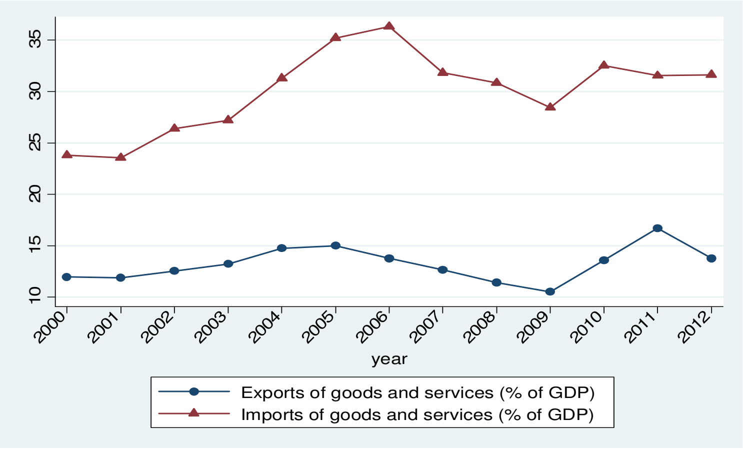

Figure 2.7 Export and import of goods and services (% of GDP)

Source: Computed from WDI databases

Ethiopia's import basket is dominated by capital goods, consumer goods, fuel, and semi–finished goods; respectively (Table 2.5).The average growth rates in total imports have increased by about 6.6% year between 2007/08 and 2010/11. Both imports of capital goods and consumer goods grew by about 13% and 14%, respectively, over the 2007/08 to 2010/11 period. Imports of raw materials and semi–finished goods have decreased in the same period by 10.7% and 0.8%, respectively. The fact that imports of capital goods increased indicates higher domestic demand for investment goods.

					Growth rates (%)
	2007/08	**2008/09**	**2009/10**	**2010/11**	**2007/08-2010/11**
Raw materials	257.8	354.2	212.4	183.8	-10.7
Semi–finished goods	1259.7	1140.1	1226.5	1228	-0.8
Fuel	1621.4	1256.7	1310.7	1659.3	0.8
Capital goods	1907.7	2474.4	2886.3	2757.1	13.1
Consumer goods	1532.3	2344.3	2515.7	2294.8	14.4
Others	231.7	157	117.3	130.5	-17.4
Total	6810.6	7726.6	8268.9	8253.5	6.6

Table 2.5 Value of imports by end-use (in million USD)
Source: *MoFED, 2012a*

If we compare export with import of goods and services, there is a huge gap. Import is far higher than export, as can be seen in Figure 2.8. The fact that imports of goods and services grew faster than exports implies deteriorations in the trade and current account balances. According to MoFED (2012a) the trade balance was about -5.5 billion USD.

(a) (b)

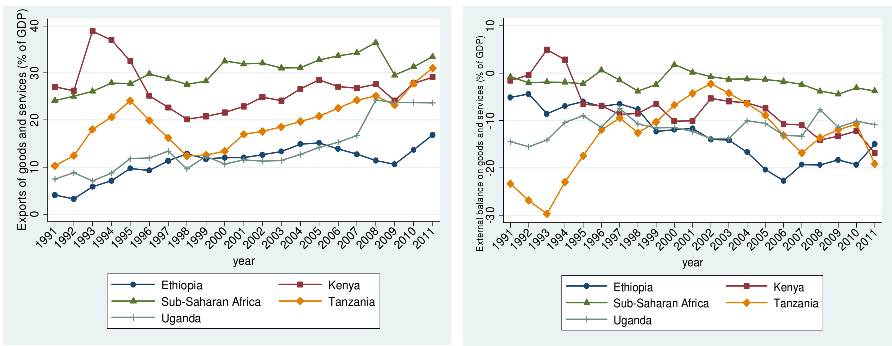

Figure 2.8 Export of goods and services and external balance (% of
Source: Computed from ADI databases

Ethiopia's performance in the external sector is inferior compared to the average of sub–Saharan Africa (SSA) and the neighboring Kenya, Tanzania, and Uganda. Figure 2.8(a) shows that Ethiopia’s export of goods and services as percent of GDP has been lower than that of the three neighbors. Similarly, the external balance on goods and services as percent of GDP has declined substantially after 2000 (Figure 2.8(b)). Before 2000, the external balance was better than the amount in Uganda and Tanzania. Between 2000 and 2011, Ethiopia's external balance appeared to have worsened falling below the comparators. According to the World Bank's (2015b) Ethiopia's economic update, the country's current account deficit has increased from

5.3% in 2012/13 to 8.6% of GDP in 2013/14 indicating the continuation of the problem. This was caused by the large imbalance in import and export of goods and services, which worsened from 16.5% to 17.8% of GDP during the same period. In tandem with the trends shown in Figure 2.6, the World Bank's (2015b) report indicates that the trade deficit was driven by poor export performance and large imports of capital goods mainly for public investment projects.

In terms of competitiveness measured by the Global Competitiveness Index (GCI), Ethiopia's performance has been lower than neighboring Kenya and Tanzania but comparable with Uganda in the 2006–2011 periods as can be seen in Figure 2.9. However, it has improved consistently over time moving up from the GCI value of 3.3 in 2006 to 3.7 in 2011. Between 2008 and 2011, Ethiopia's average GCI (3.45) was equal to that of Uganda. However, in 2011 it exceeded not only Uganda but also Tanzania.

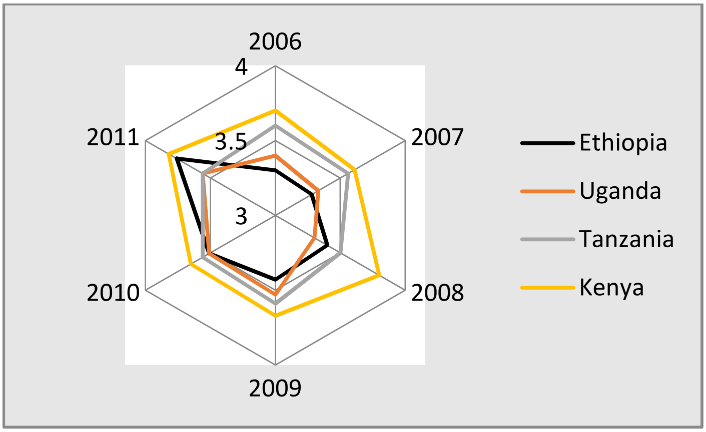

Figure 2.9 The Global Competitiveness Index[6]

Source: WDI databases

[6]It is a yearly index of the competitiveness of countries in the world compiled by the World Economic Forum as weighted average of many different components, measured in publicly available data as well as surveys.

2.3.5. DEVELOPMENT FINANCING

In order to achieve its ambitious development plans, the Ethiopian government follows a fiscal policy aimed at strengthening domestic revenue mobilization and pro-poor spending. The government has taken efforts to reduce budget deficit by increasing domestic revenue. For instance, in 2010/11 the expected budget deficit was 2.4% of GDP. However, the actual deficit was Birr 8.2 billion (only 1.6% of GDP). Between 2009/10 and 2010/11, the government raised tax revenue by 36.2% (MoFED, 2012a). In addition to raising domestic revenue, the government followed a tight fiscal policy to ease the observed inflationary pressure during this period. The largest share of public spending was allocated to capital budget compared to the amount allotted for recurrent budget. In 2010/11, the capital expenditure was 10.4% of GDP while that of the recurrent budget accounted for 7.95 of GDP (MoFED, 2012a).

	2011/12 (Mil. Birr)	**2012/13** (Mil. Birr)	**Nominal Change** (%)	**Real Change** (%)
Total revenues & grants	**54,659**	**67,497**	**23.5**	**5.4**
Tax revenues	42,102	53,930	28.1	9.3
Direct taxes	15,328	19,903	29.8	10.8
Domestic indirect taxes	10,363	14,775	42.6	21.6
Foreign trade	16,411	19,253	17.3	0.1
Non-tax revenue	7,436	7,410	-0.3	-15.0
Grants	5,121	6157	20.2	2.6
Total expenditures	**47,611**	**56,243**	**18.1**	**0.8**
Recurrent	22,638	26,219	15.8	-1.2
Capital	24,973	30,024	20.2	2.6
Balance	**7,048**	**11,254**	**-**	**-**

Table 2.6 Government revenue and expenditure
Source; IMF, 2013

The IMF (2013) indicated that 75% of public investment (budgetary and non-budgetary) in Ethiopia is financed from domestic source through budget or domestic banking system. The remaining 25% was covered by external borrowing in 2011/12 and 2012/13. The IMF (2013) also showed (Table 2.6) that the Ethiopian government generated about Birr 54.7 billion and Birr 67.5 billion of revenue and grant in 2011/12 and 2012/13, respectively. The nominal growth between these two years was about 23.5%, while the real change was only 5.4%. A significant part of the increase in domestic revenue came from direct and indirect taxes. As can be seen from the table, the nominal increases in the two types of taxes were 29.8 and 42.6%respectively. In real terms, the increases in these taxes amounted to 10.8 and 21.6%. Nevertheless, direct and indirect taxes have been the major sources of domestic revenue with indirect tax contributing the highest. IMF's (2013) data (Table 2.6) also confirms the growing emphasis of the Ethiopian government on capital budget than recurrent budget. Accordingly, over 2011/12 and 2012/13, the capital expenditure has grown by 20.2% in nominal term while growing by 2.6% in real term. The real growth in the recurrent budget, however, was negative (-1.2%) during the same period.

Therefore, there is clear evidence that the Ethiopian government has shown its commitment to reduce its budget deficit and finance its development projects mainly from domestic sources. A good example is the building of the Grand Ethiopian Renaissance Dam (GERD), which is anticipated to generate 6000 megawatts of electrical power upon completion. The construction cost (4.8 billion USD) of the GERD is to be raised from domestic sources.

2.3.6. HUMAN DEVELOPMENT

Human capital plays a definitive role in the development of a given economy. According to the World Bank, it contributes a significant proportion of the differences in the development levels of countries. Differences in the human capital of the countries depend on how much effort and resources they allocate in developing their human capital. The starting point for most countries' development is utilization of their natural capital, agricultural land, forests, and natural resources. These assets can best be used in building more wealth, including both tangible and intangible capitals. The tangible capitals are manufactured capitals that constitute basic infrastructure. The intangible capitals are mainly human and institutional capitals that are crucial for long-term development. AfDB *et al.* (2013) indicated that African countries can promote structural transformation by translating natural resource wealth into long-term growth and human development, which can in turn be achieved through investing in better health and education and ensuring the long-term sustainability of renewable natural resources.

The pro-poor policy followed by the Ethiopian government has primarily aimed at reducing poverty by increasing agricultural productivity, building infrastructures to improve access to basic utilities like water, electricity, transportation, health, and education. The national poverty head count (incidence of poverty) indices were 0.455 in 1995/1996, 0.442 in 1999/00, 0.387in 2004/2005, and 0.296 in 2010/11. The poverty index has declined by 12.4% between 1999/00 and 2004/2005. The decline was substantially higher (24%) between 2004/05 and 2010/11 (MoFED, 2012b). Access to clean water, electricity, health services, and education has seen improvement over the last two decades. The ADI database shows that Ethiopia's public health expenditure, which was only about 5.9% of the total government expenditure in 1995, has reached 14.6% in 2011. The water supply coverage reached 97% in urban areas and 39% in rural areas with the total coverage of 49%. Electricity consumption had grown from 2619 to 4315 millions of kilowatt hours.

The other key contributor to human development is the education sector. Ethiopia has seen a dramatic change in improving this sector by investing in infrastructure and establishing supportive institutions. Over the last two decades, citizens have gained better education opportunities from primary to higher levels. Consequently, net primary school enrollment has increased fourfold between 1994 and 2011 (86%), while tertiary enrollment has increased from 0.6% to 7.6%of gross enrollment during the same period. In order to show Ethiopia's commitment and performance in education, let us compare it with three neighboring countries with respect to the selected indicators as presented in Table 2.7.

Selected education indicator	**Ethiopia**	**Kenya**	**Tanzania**	**Uganda**
Government expenditure on education as % of GDP (%)	4.5 (2013)	5.5 (2010)	3.5 (2014)	2.2 (2013)
Expenditure on tertiary as % of expenditure on educ. (%)	42.7 (2013)	15.4 (2006)	21.4 (2014)	13.8 (2013)
Expenditure on educ. as % of total govt expenditure (%)	27.0 (2013)	20.6 (2010)	17.3 (2014)	11.8 (2013)
Gross enrollment ratio,[7] primary, both sexes (%)	100.1 (2014)	116.1 (2012)	86.8 (2013)	109.9 (2013)
Gross enrollment ratio, secondary, both sexes (%)	36.2 (2012)	67.6 (2012)	32.3 (2013)	27.6 (2013)
Gross enrollment ratio, tertiary, both sexes (%)	6.3 (2014)	4.0 (2009)	3.6 (2013)	4.5 (2011)
Adjusted net enrollment rate,[8] primary, both sexes (%)	86.5 (2014)	86.2 (2012)	81.9 (2013)	93.8 (2013)
Adjusted net enrollment rate, primary, female (%)	83.6 (2014)	88.0 (2012)	82.4 (2013)	95.3 (2013)
Adjusted net enrollment rate, primary, male (%)	89.3 (2014)	84.4 (2012)	81.5 (2013)	92.3 (2013)
Adult literacy rate,[9] population ≥15 years, both sexes (%)	39 (2007)	72.2 (2007)	79 (2012)	70.2 (2012)

Table 2.7 Government expenditure and enrollment rate in education

[7]Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown.

[8]Adjusted net enrollment is the number of pupils of the school-age group for primary education, enrolled either in primary or secondary education, expressed as a percentage of the total population in that age group.

[9]Adult literacy rate is the percentage of people ages 15 and above who can both read and write with an understanding of a short simple statement about their everyday life.

Note: Figures in parentheses show the latest year for which data are available in WDI database.

Table 2.7 indicates that in 2013, Ethiopia spent about 4.5% of its GDP on education, which is lower than Kenya’s expense in 2010 (5.5%) but higher than Tanzania's and Uganda's expense in 2014 and 2013, respectively. In terms of expenditure on tertiary education as percentage of expenditure on education, Ethiopia spent more than double of the three comparators in their respective data periods. Out of its total expense in 2013, Ethiopia spent 27% for education while Kenya, Tanzania, and Uganda allocated 20.6%, 17.3%, and 11.8%, respectively.

In terms of gross enrollment ratio (GER) in both primary and secondary education, Ethiopia performed better that Tanzania and Uganda but lower than Kenya. However, in tandem with the government's higher expense on tertiary education, Ethiopia's GER in tertiary education for both sexes (6.3%) was higher than the three comparators given the differences in the year of data. This may be related to Ethiopia's commitment that added more than 30 public universities over the last 24 years to the only two universities that existed before 1991. Ethiopia and Kenya appeared to be equal (86%) in terms of adjusted net enrollment rate in primary education for both sexes but lower than that of Tanzania (94%). However, the figure is lower in Ethiopia than in Kenya when only female enrollment is taken into account. Tanzania exceeded all the others for both male and female enrollment.

Adult literacy and enrollment in primary, secondary, and tertiary education in population can be used to measure the skill level of the population (Fagerberg, Lundvall, and Srholec, 2016), also called social capability, which is important for the capability of a country to absorb foreign technology. To include other factors, let us extend the comparison using the human development index (HDI), which is a composite measure of all aspects including economic, social, and political developments in a country. Figure 2.10 shows HDI based on the Mo Ibrahim Index (MoHDI) presented in panel (a) and the World Bank's HDI depicted in panel (b) for Ethiopia, Kenya, Tanzania, and Uganda in 2000–2011. MoHDI measures two aspects: the first is health and welfare and the second is education. The HDI measures every social, economic, and political aspect of human beings. From this figure, we can see that Ethiopia is below all the comparators while Kenya is superior with respect to both measures of human development. The average MoHDI of Ethiopia, Kenya, Tanzania, and Uganda in the period was 45.3, 58.3, 51.9, and 53.5, respectively. Similarly, the respective average HDIs of these countries were 0.36, 0.48, 0.42, and 0.41 in 2005–2011.

However, in terms of the growth rates in human development, Ethiopia exceeds the other countries indicating improvements in the period with the possibility of catch-up in the future. Between 2005 and 2011, Ethiopia's HDI had increased by about 60.8%, which is higher than the growth in Kenya (48.5%), Tanzania (53%), and

Uganda (54.6%). The steepness of the graphs of MoHDI and HDI corresponding to Ethiopia also highlights this fact. The important point to be noted from the above comparison is that even though Ethiopia is below its neighboring comparator countries in the levels of human development, she is progressing better than them in terms of growth in human development over the sample period.

(a) (b)

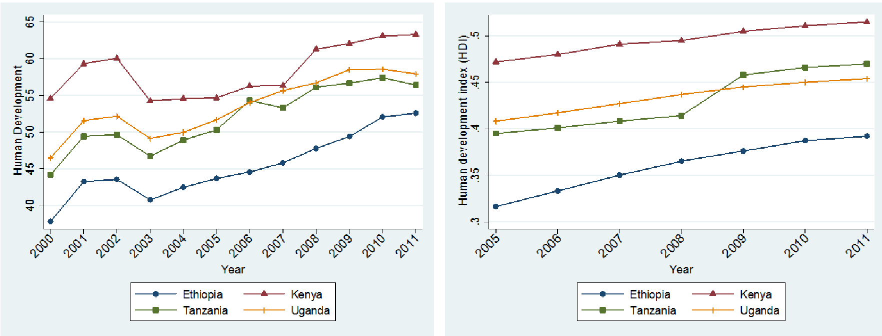

Figure 2.10 Human Development Index

Source: Computed from ADI databases

We believe that the above macroeconomic data has something to narrate about the social, economic, and institutional factors that can directly or indirectly affect firm-level performance. For example GDP has implications for the government's capability to provide supportive infrastructure; inflation rate is a good indicator of economic stability, which affects the price of inputs and outputs of firms; unemployment has its own indication on labor cost; HDI would determine the quality of human resource; and so on. Conditioned by the macroeconomic environment, firm-level performance has an important contribution in facilitating structural transformation of the overall economy. The following section discusses the structural transformation of Ethiopian economy.

2.4. STRUCTURE OF THE ETHIOPIAN ECONOMY AND ITS PACE OF TRANSFORMATION

The agricultural sector plays a dominant role in Ethiopia's economy in terms of its share in GDP, employment, and export earnings. In 2005/6, agriculture contributed about 47.1% to the national GDP (44 billion Birr followed by the service sector, which accounted for the remaining 40.4% as can be seen in Table 2.8. The industrial sector contributed only the reaming 13.4%. However, in 2010/11 and 20012/13, the share of agriculture declined to 41.1% and 42.9%, whereas the share of the service sector increased to 46.6% and 45.2% in the respective years. There was no change in the share of the industrial sector in 2010/11, while it has decreased by 1% in

2012/13. In terms of annual growth rates, both agriculture and service have shown a decline in 2010/11–2012/13. Growth in the contribution of the industrial sector, however, increased from 10.2% in 2005/6 to 18.5%in 2012/13 despite its marginal contribution in the overall GDP. The overall GDP of Ethiopia stood at about 94 billion Birr with annual growth rate of 11.5% in 2005/6. In 2012/13, this value had jumped to over 559 billion Birr with 9.7% annual growth rate. These figures show that the role of agriculture in the Ethiopian economy appears o be lower than that of the service sector.

	GDP - 2005/6		GDP - 2010/11		GDP - 2012/13	
Sector	Birr (Mil.) [%]	Annual Growth Rate	Birr (Mil.) [%]	Annual Growth Rate	Birr (Mil.) [%]	Annual Growth Rate
Agriculture	44,062 [47.1]	10.9	64,698 [41.1]	9	238,700 [42.9]	7.1
Industry	12,561 [13.4]	10.2	21,177 [13.4]	15	69,100 [12.4]	18.5
Services	37,747 [40.4]	13.3	73,368 [46.6]	12.5	251,800 [45.2]	9.9
Total GDP	94,371 [100]	11.5	159,244 [100]	11.4	559,600 [100]	9.7

Table 2.8 Sectoral components and growth in GDP by year
Source: MoFED, 2011, 2012a, and 2013

Similar patterns of sectoral contribution prevail in terms of the value added as percent of GDP. As can be seen from Figure 2.10, the share of agriculture in the value added of GDP came a long way from over 60% before 1995 to 40% in recent years. The shares of agriculture and service seem to be comparable after 2003 while that of the industrial sector remained constant. The dominance of service sector is extremely high in the neighboring Kenya through the entire sample period (1990–2011), as can be observed in the top right of Figure 2.11. Tanzania and Uganda started to experience the dominance of the service sector during 1998, after which agriculture remained in between the service and the industrial sectors.

The dynamics of sectoral composition has some peculiarities for all the comparators. Ethiopia seems to be more dependent on the agricultural sector for a longer period than the remaining countries, while Kenya has shown more resemblance to the structure of advanced countries' economy in terms of the share of the service sector. However, its industrial sector accounts for a smaller share in the GDP as opposed to that of advanced economies. The similar feature of all the neighboring comparators is that all have substantially higher reliance on agriculture and their industrial sectors contribute less than 20% in their respective GDPs in terms of value added. In relative terms, Ethiopia's economy looks more traditional than the comparators. Uganda and Tanzania have begun to generate greater or equal to 20% of their GDP from the industrial sector post 2002.

Despite its long dependence on the agricultural sector, Ethiopia's economy has been recognized as amongst the fastest growing non-oil economies in the world. The share of agriculture in total output has been steadily declining, while that of service and industry registered remarkable growth. Specifically, the service sector plays a leading role in the growth of the economy accounting for nearly half of the overall growth in GDP.

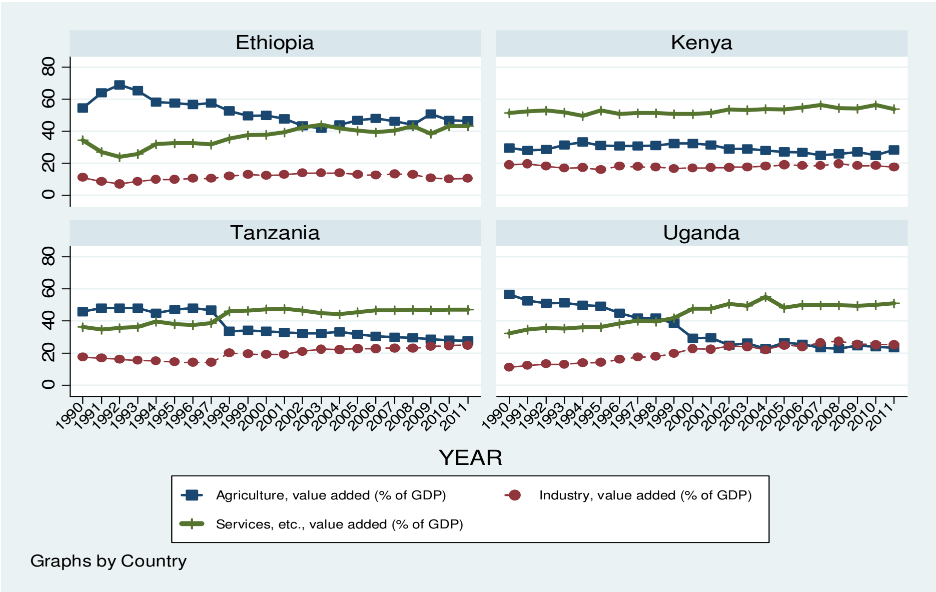

Figure 2.11 Sectoral value added (% of GDP)
Source: Computed based on ADI data base

Similar to most African countries, Ethiopia's export basket is dominated by primary agricultural products as we have already seen in the previous section. Out of the total merchandize export, the agriculture sector makes more than 80%in 2000–2012 (Figure 2:12(a)). There are significant differences between Ethiopia and the three comparators in the dynamics of the composition of merchandize export. As seen in the figure, the role of the agricultural sector has significantly declined over the same period while the share of manufacturing sector has been rising. Panel a and panel b of the figure demonstrates this fact by which Ethiopia's graph (agriculture) is high at the top of panel (a) while it is far lower in panel (b) of the same figure.

The declining trend of agriculture in Tanzania's export basket was stronger than Kenya and Uganda, whereas the rising share of manufacturing in total merchandize export was higher for Kenya. There has been some improvement in the share of manufacturing in the Ethiopian export between 2004 and 2012, yet insignificant compared to the three neighboring countries. Kenya's performance is spectacular in manufacturing as the decline in the share of agriculture has been accompanied by the increasing share of manufacturing more than others. The steep declining of the agricultural sector in Tanzania's export basket has been due to the rising proportion of fuel and mining products in the same period.

(a) (b)

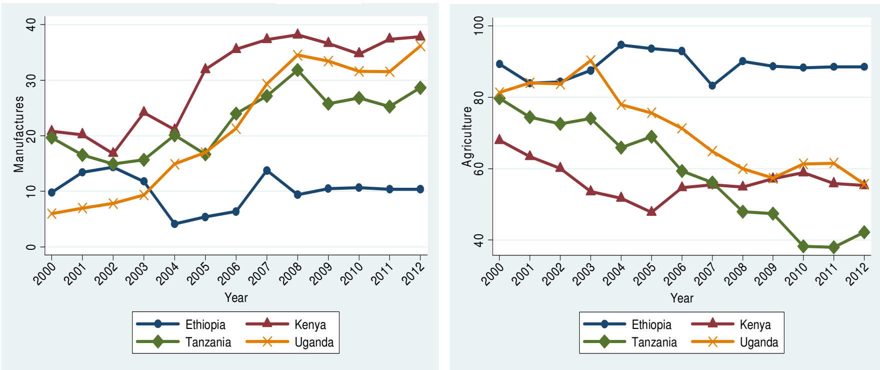

Figure 2.12 Sectoral contribution of export (% of total merchandize export)

Source: Computed based on WTO's data base

The concentration of Ethiopia's export in agricultural products is one of the key challenges yet to be tackled by the government. The observed trends on the above figure need to be reversed if the country has to be more competitive in the global market. Despite the absolute disadvantage of export compositions, Ethiopia performed better in terms of export product diversification, which of course is related to diversification in the commodity sector. Between 1995 and 2002, Ethiopia's export diversification index had been far lower than Kenya, Tanzania, and Uganda (Figure 2.13). However, it had started to improve and catch-up these countries after 2000. After 2006, it has even over taken to lead the comparators with an index of about 0.8. When we see this development in view of the "product space" concept contributed by Hidalgo *et al.* (2007), it seems that Ethiopia is easily moving within its "product space" better than its comparators. It is of course understood that all these countries are at the periphery far from the richest countries' "product space," according to these authors.

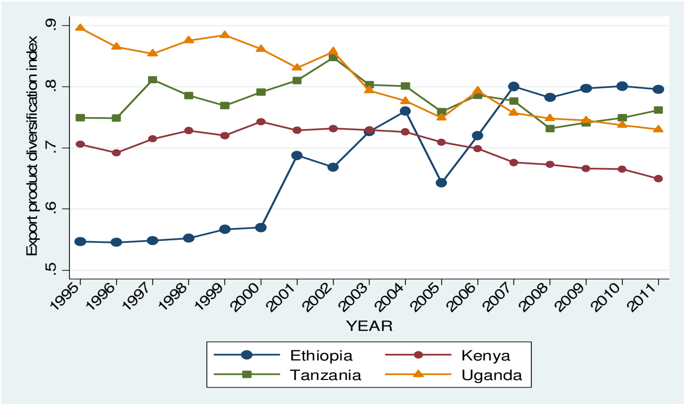

Figure 2.13 Export product diversification

Source: Computed based on ADI data base

Similar trends with export and GDP composition of sectors prevail in terms of employment. Agriculture employs about 80% of the Ethiopian labor force. In 1999, agriculture, industry, and service contributed 79.8, 5.5, and 14.5% to the total employment, respectively. Industry and service sectors absorbed less than the average employment generation of these sectors in sub–Saharan countries in 1998 and 2008.

	Ethiopia				sub–Saharan Africa		
Year	Agriculture	Industry	Service	Year	Agriculture	Industry	Service
1999	79.8	5.5	14.5	1998	66.7	7.9	25.4
2005	80.2	6.6	13.1	2008	61.0	8.9	30.2
2013	72.7	7.3	19.9				

Table 2.9 Employment by sector

Source: MoLSA, 2013, and the Ethiopian labor force survey

However, as can be seen in Table 2.9, the sectoral structure of employment shows that the share of employment in agriculture has decreased by about 8% (between 2005 and 2013). On the other hand, the share of the service sector in employment has increased from 13%in 2005 to 20% in 2013. The contribution of the industrial sector remained low with only marginal addition (1%). The significant increase in the share of the service sector in the GDP and employment of the country implies the tendency of the Ethiopian economy to be led by service as opposed to the government's plan.

The above analysis demonstrates the status and changes in the structure of the Ethiopian economy in relation to its comparators in East Africa. In view of the government's intention to increase the role of the industrial sector, there has been no significant achievement. Other countries appeared to have achieved better than Ethiopia. It also indicates the clumsy step of the Ethiopian economy toward structural transformation. The most important aspect of structural transformation is shifting labor from lower to higher productivity sectors, thereby increasing overall productivity. In the African context, increasing productivity of the agricultural sector and shifting labor to the more productive sector have been considered key for transformation (McMillan and Rodrik, 2011). Thus, it is important to elaborate these aspects so that we can have some knowledge on the status of the economic transformation in Ethiopia.

2.4.1. STRUCTURAL CHANGE

Accelerating structural change requires moving workers into more productive sectors, diversifying export products into more value added than primary natural resource-based commodities. It also requires appropriate policy measure or incentives for a country to jump from a less connected product space to a denser product space, which shows broader opportunity for structural transformation (Hidalgo *et al.*, 2007). As we have observed, the majority of workers in Ethiopia are still in agriculture, which is characterized by traditional farming system and low productivity. The sector has also been the dominant force of growth and export revenue in the country over a longer period of time. In recent years, the service sector has shown equal importance in growth. According to its recent Ethiopian economic update, the World Bank (2015b) economic growth averaged 10.9% per year from 2003/04 to 2013/2014 compared to the regional SSA average of 5.4%. Services and agriculture sectors together accounted for almost 90 percent of GDP during this period.

Successful structural change is characterized by increased aggregate productivity. Increasing the productivity of individual firms, and improving allocative efficiency by shifting resources from less productive firms to those that are more productive are the two main channels for improving aggregate productivity. The World Bank (2015b) indicates that labor productivity of firms in Ethiopia appear to be relatively higher when compared to firms in other countries at similar levels of development, such as Zambia and Vietnam. In 2009, the median firm in Ethiopia produces about $4,900 of output (value added) per worker. However, the observed higher labor productivity is due to higher capital intensity rather than improvement in the efficiency of production (World Bank, 2015b).

Ethiopia has experienced significant growth in aggregate labor productivity between 2005 and 2013. Ferede and Kebede (2015) showed that productivity has increased from 8.9 thousand Birr per worker in 2005 to 13.2 thousand Birr in 2013 at 2010/11 constant prices. Upon dividing aggregate labor productivity growth into within-sector and structural change effect, they found greater dominance of the former, as can be seen in Table 2.10. According to their analysis, the aggregate labor productivity growth is about 0.473 out of which 0.308 (65%) is attributed to within-sector productivity growth. Structural effect, which consists of employment and the interaction effects, contributed the remaining (35%) of the total labor productivity growth. The employment effect alone contributes about 40% to the total labor productivity growth.

The negative contribution of the interaction effect to the overall labor productivity growth indicates that sectors with fast-growing labor productivity are more likely to lose their shares in total employment than sectors with lower labor productivity growth. Ferede and Kebede (2015) noted that the negative effect can be larger if sectors with high productivity growth are faced with declining employment shares. The analysis shows that agriculture, manufacturing, electricity, and water sectors had declining employment shares with positive labor productivity growth. In contrast, transport and communication and other services exhibited negative productivity growth with increasing share in total employment.

		Structural change effect	
Sector	Within-sector	Employment effect	Interaction effect
Agriculture, hunting, forestry & fishing	0.180	-0.048	-0.017
Mining &quarrying	0.004	0.006	0.003
Electricity, gas and water supply	0.014	-0.005	-0.005
Manufacturing	0.028	-0.003	-0.002
Construction	0.020	0.015	0.008
Wholesale and retail trade	0.077	0.006	0.003
Transport and communications	-0.009	0.046	-0.010
Other services	-0.006	0.174	-0.005
Total	**0.308**	**0.191**	**-0.026**

Table 2.10 Sectoral structure of labor productivity growth, 2005–2013
Source: Ferede and Kebede (2015)

The largest share (58.4%) of the aggregate labor productivity growth came from the agriculture sector. Industry and service sectors contributed nearly equally accounting for 21.4% and 20.1%, respectively. The contribution of manufacturing activity to the aggregate productivity growth was about 9.1%. In terms of employment, the service sector generated the largest while other sectors have experienced negative effect. The negative employment effect for agriculture and manufacturing, on the one hand, and the positive effect for services and construction sectors, on the other, signifies shifting of labor from productive sectors to services. Similarly, the negative interaction effect, particularly for agriculture and manufacturing, indicates that these sectors are not driving employment transfer from other sectors and also the fact that new jobs have been created in sectors with declining productivity (Ferede and Kebede, 2015).

In order to see the relative performance of Ethiopia in terms of structural transformation, it is important to compare against some countries in the region. To this end, we present (in Table 2.11) the decomposition of productivity growth of some countries in Africa analyzed in AfDB *et al.* (2013). As can be seen from the table, the aggregate labor productivity growth of Ethiopia between 2000 and 2005 was 2.1%, which is slightly lower than the average growth of Africa (2.2%) during the same period. Compared to some of its neighboring countries, Ethiopia registered higher growth than Kenya and Uganda but lower than Tanzania.

However, Ethiopia's productivity growth was mainly contributed by the within-sector movement of labor accounting for 98.6% of the total growth, which is far higher than all the comparators. Out of the average productivity growth in Africa, the within and structural components accounted for 60 and 40%, respectively. Both components contributed nearly equal amounts in the aggregate productivity growth of Kenya. As opposed to Ethiopia, Uganda had generated the entire productivity growth from movement of labor between sectors. This component had generated the largest part (76%) of the total labor productivity growth.

	Growth (%)	Within component-labor movement within sectors (%)	Structural component - labor movement between sectors (%)
Ethiopia	2.09	2.06	0.03
Kenya	0.57	0.29	0.27
Tanzania	3.17	0.76	2.41
Uganda	1.78	-0.88	2.65
Africa	2.18	1.31	0.87

Table 2.11 Decomposition analysis of productivity growth (2000–2005)
Source: AfDB *et al.* (2013)

The above comparison shows that Ethiopia performed poorly in moving labor from less productive to high productive sectors. The fact that agriculture is the main source of aggregate productivity, the low level of labor productivity in agriculture and manufacturing indicates poor transformation of the economy. All the country's development plans and strategies have been designed around poverty eradication and job creation through economic transformation, which is yet to be realized. In fact, this could depend on country contexts and the dynamics of the business cycle. Holm (2014) indicated that industry selection effect plays a negative role on structural transformation during expansion or boom in the business cycle by inducing movement of resources from high productivity to low-labor productivity industries. During the trough and contraction, however the opposite effect prevailed. In relation to the country context, industrial policy plays an important role. The following section gives an overview of Ethiopia’s industrial sector and evaluations on some of the efforts toward industrialization.

2.4.2. THE INDUSTRY SECTOR AND EFFORTS TOWARD INDUSTRIALIZATION

In the Ethiopian context, the industry sector constitutes mining and quarrying, manufacturing, construction, electricity, and water. The emergence of the industry as an economic entity was not before the turn of twentieth century following the implementation of Ethio-Djibouti railways and the strengthening of foreign relations (Gebreeyesus, 2013). According to Getenet and Admit (2001), the pioneering policy initiative in the history of the Ethiopian industrial development came after the arrival of the technical mission from the United States of America (USA) in 1944 upon the request of the Ethiopian government for economic assistance. This mission helped the government in setting the ten-year program of industrial development (1945–1955). In his extensive review of the country’s industrial policy, Gebreeyesus (2013) described the mid-1950s as the starting time for a conscious policy aimed at stimulating the growth of the industrial sector through the first five-year plan (FFYP) by the imperial regime. During these periods, the basic tenet of the government was to realize industrial development by pursuing import-substitution strategy and relying on foreign capital for investment in the industrial sector.

Specific policy tools applied to channel investment into the manufacturing sector include shielding domestic firms from foreign competition through high tariff and banning selected imports, fiscal incentives, and provision of credit. In FFYP, the government was supposed to support industrial development through infrastructure and human resource development and direct involvement in selected sectors mainly those demanding high initial capital. In addition to direct investment in the selected manufacturing sector, such measures were extended and strengthened also in two successive five-year plans of the imperial regime. The philosophical ground of the industrial policy in this regime was to accelerate market and private sector development, while government intervention was aimed at areas where markets fail (Gebreeyesus, 2013).

Gebreeyesus (2013) cited the World Bank’s report regarding the success of the policy initiative in terms of attracting foreign investors and developing the manufacturing sector on the one hand while disclosing the practical deficiency of the initiative, on the other. He described the biases it suffered in favor of import substituting, large, capital-intensive, and foreign-dominated industrial activities. Eventually, by the end of the plan period, the policy measures had fallen short of building the required industrial base for the country’s economy.

Following the collapse of the imperial regime in 1974, the military (Derg) regime nationalized most of the medium- and large-sized manufacturing enterprises and restricted private sector participation only to small-scale industries and handicraft activities (Gebreeyesus, 2013). Various restrictions came into effect pertaining to the private sector and the market operation. Private investment was set not to exceed

250 USD while at the same time entrepreneurs were not allowed to engage in more than one venture. Price controls, labor market regulation, import restrictions, and fixed exchange rate were also imposed. Industrial development was included in the ten-year (1985–1994) perspective plan (TYPP) with the aim of promoting import-substituting and labor-intensive industries. The public sector investment was entrusted to lead all the ways towards industrialization (Gebreeyesus, 2013).

The economic reform introduced, following the regime change in 1991, opened a new era of industrialization. Favorable conditions have been created for private business to both local and foreign firms. In its recent plan, the current government envisages the transformation of the economy by commercializing the agricultural sector and significantly increasing the share of the industrial sector in the GDP (FDRE, 2010). The government declared itself a developmental state to pursue an activist role to address market failures and accelerate growth, taking South Korea and Taiwan as its models. It has extended its support for the target key sectors such as textile, garment, and manufacturing of leather and leather products in the form of access to long-term subsidized credit, convenient access to land, tax incentives, and government facilitation (Gebreeyesus, 2013).

Industrialization in general and the development of manufacturing activities in particular, on both national and regional scales, are critical for accelerating the process of structural change in Africa (UNCTAD, 2012). Ethiopia’s industrial development plan reflected this fact and sought to be achieved through a neo-structuralist policy approach. A typical measure was the identification of the priority sector as textile and garment industry, meat and leather products industry, agro-processing industry, and construction industry. Special supportive institutes and training programs have been formed for each of the sectors. These sectors are believed to help the Ethiopian economy advance along the ADLI strategy. Owing to their labor-intensive nature, the sectors are vital in terms of creating larger employment. Moreover, they involve more value addition for export and are closely linked to the agricultural sector (Sutton and Kellow, 2010).

However, the competitiveness of the industrial sector in Ethiopia has been very low compared to the average of countries in SSA and the world. According to UNIDO (2013), Ethiopia ranked at 22 among 25 SSA countries in terms of industrial competitiveness. The neighboring countries of Kenya and Uganda ranked 10 and 16, respectively. Worldwide, Ethiopia ranked 130 while Kenya and Uganda stood at 102 and 120, respectively. The only three countries that ranked below Ethiopia in SSA are Central African Republic, Burundi, and Gambia. The dismal performance of the Ethiopian industry sector can also be seen in terms of its value added in GDP compared to the average of the SSA region as shown in Figure 2.14. The figure indicates that industry value added as percent of GDP in Ethiopia is far below the average of SSA countries in 1992–2011. It was below 15% even during its peak unlike the average value of the SSA, which was far above 20% when countries in all income groups are included and when South Africa and Nigeria are excluded.

Despite these facts, some evidence shows that Ethiopia is doing well in its industrialization. On his evaluation of the Ethiopian industrial policy, Altenburg (2010) appreciated the advancement of policymaking over the last few years. He also acknowledged the designing of flexible and appropriate policies for varied challenges. However, he is critical of the policy-forming process. Particularly, he described that the policy making process has been solely handled by the government with less transparency and without considering the role of the private sector. Moreover, there have been complaints about the covert relationship government and ruling party hold with state-owned enterprises (SOEs) and endowment-owned enterprises pertaining to their implication for the expected level-playing ground to all companies (World Bank, 2009; Altenburg, 2010; Gebreeyesus, 2013).

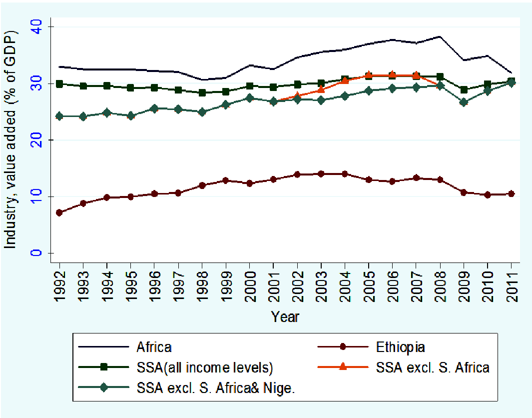

Figure 2.14 Industry value added (% of GDP)
Source: ADI, 2013 database

Oqubay (2015) also appeared to have documented unique evidence on the effectiveness of policy making in the Ethiopian industrial sector. The author argues that Ethiopia has followed and effectively implemented a developmental state ideology contextualized with the country's condition in a tone that the case deserves to be taken as exemplar for the rest of developing countries. Active involvement of the state has been applauded to have achieved the purpose for which it was designed. It is true that the economic turnaround that has been observed post-reform has played a remarkable role. Privatization, creating better environment for private business development, public investment on infrastructure, and improvement in the institutional environment are among the main reasons for the development of the industrial sector, in particular, and the better performance of the overall economy, in general. Nevertheless, the underdevelopment of the industrial sector indicates persistence of key challenges. In relation to this, the following subsections present a critical evaluation of some of the measures taken in relation to their roles in fostering the industrialization process.

2.4.2.1 Investment and fixed capital formation

As a condition for achieving the anticipated economic transformation, the Ethiopian government committed itself to follow proactive public policies with heavy involvement in infrastructure and industrial investments. This has been reflected over the last several years in its growth performance fueled by heavy public investment (IMF, 2013). In 2011, Ethiopia was the third largest in the world in terms of public investment to GDP ratio (18.6%) exceeded only by Turkmenistan (38.6%) and Equatorial Guinea (24.3%) (World Bank, 2013). The largest proportion of investment has been channeled to infrastructures such as schools, road, railway, hydroelectric power generation, housing, health facilities, telecommunication, irrigation schemes, and sugar manufacturing plants, among others.

Indeed, effective transformation of an economy requires investment in both human and physical capitals, particularly, machinery, equipment, and structures that enhance productivity. In underdeveloped economies, public investment in infrastructure has been essential, acting both in terms of providing required services and in stimulating private investment (UNCTAD, 2012). Compared to three other east African countries, Ethiopia's gross public investment as a percent of GDP (Figure 2.15) has significantly grown over recent years. Before 1994, public investment in Ethiopia was far lower than Kenya, Tanzania, and Uganda. After 1996, however, public investment in the three countries remained far lower (less than 10%) than the amount in Ethiopia (greater than 10%).

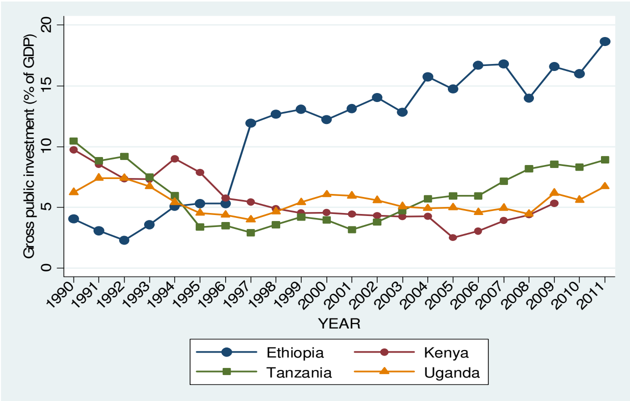

Figure 2.15 Gross public investment (% of GDP)
Source: Computed based on ADI data base

Similarly, Ethiopia's gross fixed capital formation has been high compared to the average of SSA. Figure 2.16 shows trends in fixed capital formation over the time span of 1992 to 2011. The graphs depict that with the exclusion of the periods before 1997 and 2008, Ethiopia's gross fixed capital formation was far higher than SSA countries.

(a) (b)

Figure 2.16 Gross fixed capital formation (% of GDP)
Source: ADI, 2013 database

In contrast to this, the private investment rate in Ethiopia in 2011 was the sixth lowest in the world, which about 7%. Only Angola (2.8%), Azerbaijan (3.9%), Swaziland (5.2%), South Sudan (6.6%), and Malawi (6.6%) had registered lower rates than Ethiopia. Indeed, unlike the above figure, Ethiopia performed lowest in the private sector's gross fixed capital formation than SSA, as can be seen in panel (b) of Figure 2.16. This seems to be exacerbated by the government's measure to make direct investment in areas where it believed are in short supply of the private sector. According to Gebreeyesus (2013), the direct investment has been expanded during the GTP period. The establishment of two big state corporations namely Metal and Engineering Corporation (METEC) and Sugar Corporation made up of some existing and other newly founded SOEs is the major evidence. The government also embarked on new and expansionary investment in textile, garment, accessories, rubber tree production, coal, phosphate fertilizer cement factory, ceramics, pulp and paper production (Gebreeyesus, 2013).

Panel (b) of the graph shows that gross fixed capital formation in the private sector as percent of GDP has declined sharply after 1995, whereas the average for SSA and all African countries had remained higher and stable over the same period. The superiority of Ethiopia in total gross fixed capital formation compared to the average of SSA on the one hand and its inferior performance specific to private sector, on the other, poses the threat of the crowding-out effect of the public sector. Related to this, IMF's (2013) report recommended policymakers to maintain an appropriate balance between public and private sectors to enhance the resiliency of the country's developmental model. The report underlined the crowding-out effect of public sector projects in terms of their heavy dependence on domestic financing and foreign exchange availability. As a direction, the IMF report indicated that it was insisted that the authorities reduce and streamline the role of public enterprises and give their due emphasis for building a strong and vibrant private sector to sustain growth and achieve the desired middle income status envisaged in GTP.

2.4.2.2 Incentives for doing business

In addition to improving the required infrastructure for private investment, the Ethiopian government claims to have laid conducive ground for doing business. The main incentives include easy access to finance, exemption from custom duties on capital goods and related spare parts, and various tax holiday schemes that range from two to five years. However, World Bank's (2015c) Doing Business report indicates that Ethiopia's overall business climate rankings are relatively low. Compared to 189 countries, Ethiopia ranked 124th in 2013, and dropped to 125th in 2014. Despite its low general ranking, the country performed better than peers in Doing Business Rankings of specific business regulatory measures. Some of the themes are presented in Table 2.12 to show the country's status.

	Ethiopia	**Kenya**	**Uganda**	**SSA**
Starting a business	168	143	166	129
Getting credit	165	116	131	122
Getting electricity	82	151	184	139
Registering property	104	136	125	125
Getting construction permit	28	95	165	111
Trading across borders	168	153	161	142
Enforcing contract	50	137	80	121
Resolving insolvency	74	134	98	128

Table 2.12 Ease of doing business
Source: World Bank, 2015c

Among the specific selected measures of doing business in Table 2.12, Ethiopia ranked the least in terms of starting a business (168), getting credit (165), and trading across borders (168). However, getting a construction permit was the easiest with the rank of 28 out of 189 countries. Enforcing contract, resolving insolvency, getting electricity, and registering property are easier in Ethiopia than Kenya, Uganda, or any SSA country. This indicates that the Ethiopian government has made progress in improving some aspects of doing business, while there are many other aspects that constrain business. For instance we can see that starting a business, trading across border, and credit accesses are among the limitations of doing business in Ethiopia.

The playing ground also has not been equally level for private and public owned firms. SOEs and endowment-owned enterprises are alleged to have better access to land, credit, foreign exchange, and other government support services. For these reasons, they outperform their private counterparts in their performance. Private entrepreneurs, on the other hand, described that they face major constraints in terms of tax administration, customs and trade regulations, access to land, cost of finance, and corruption practices (World Bank, 2009; Altenburg, 2010). The bottom line is that Ethiopia, as a developmental state, should not seek to replace the private sector through state ownership or to directly control large parts of the economy. Instead it has to fulfill its vision through design policies and institutions that harness private ownership, the animal spirits of entrepreneurs, and the drive for profits to achieve the country's economic development goals (UNCTAD, 2012).

World Bank (2015b) pointed that foreign firms enjoy a relatively better treatment from the government bureaucracy than local firms. However, there are common obstacles that foreign firms indicated as threats. Oqubay (2015) documented that logistics and cumbersome custom procedures, shortage of foreign exchange, acute inefficiency in local financing for expansion, power outages, and supply chain are the main obstacles. Nevertheless, there are positive signs for the growing interest of foreign firms to invest in Ethiopia.

2.4.2.3 FDI attraction

Ethiopia's industrial development plan spells out the need to build on both domestic and foreign private investment. The role of FDI was well acknowledged in many respects. Primarily, FDI is the second source of private sector development to help achieve sustained and broad-based economic growth. Second, it creates job opportunities for both skilled and unskilled labor forces. Third and most importantly, it will have a positive externality for local firms and entrepreneurs. Taking this into consideration, the government formulated an attractive policy regime for foreign investors with respect to investment protection and profit repatriation. The investment law as well as the constitution guarantees private property protection and the repatriation of capital and profit (Investment Proclamation No. 769/2012). As Sutton and Kellow (2010) described, FDI would be an increasingly important route to industrial growth for Ethiopia. Like many other Africans, Ethiopia has not been among the major host of FDI. In relative term, Ethiopia's net FDI inflow has been far below the amount for SSA countries. However, in absolute term, it has received sustainably higher FDI over the last two decades, which is sufficient to support a medium-term growth (Sutton and Kellow, 2010).

Figure 2.17(a) shows that FDI in Ethiopia had been very low before 1997. After that, it has gradually increased despite some rise and fall. It is apparent from the graph that the annual average inflow is higher ($409 million) between 2003 and 2007 compared to just $214 million 1998–2002. In recent years, the net inflow of FDI has risen sharply. UNCTAD (2011) indicated that there could have been better inflows had there been stronger promotional and targeting efforts in place by the concerned government agency. Compared to the average for SSA, Ethiopia's FDI attraction is very negligible. For instance, the mean annual net inflow to SSA in 2004–2011 was \$27.8 billion, while that of Ethiopia amounted only to \$352.8 million. However, when FDI net inflow is taken as a percent of GDP (panel (b)), patterns similar to absolute measures emerge comparable with that of SSA comparators except during 1992–1996 and post 2006. The decline in the later period seems to have followed the trend of global financial crisis.

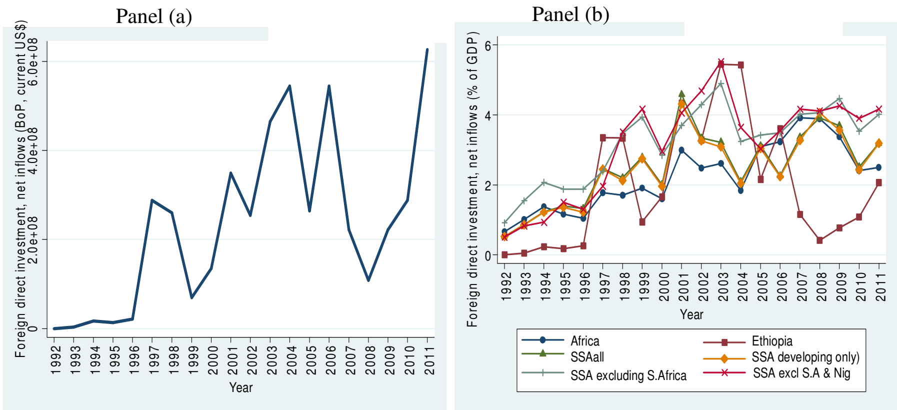

Figure 2.17 FDI inflow to Ethiopia and SSA
Source: ADI database

According to Sutton and Kellow (2010), the wide range in Ethiopia's FDI both in terms of country of origin and in terms of industrial sectors has been prominent. They mentioned four countries of origin that stand out as leaders: China, India, Saudi Arabia, and Italy. In terms of sectoral engagement, Sutton and Kellow (2010) identified China to have spanned every sector of the country's economy. However, clothing and textiles, building materials, plastics and metals and engineering accounted for the largest part of Chinese investment in Ethiopia. More interestingly, Chinese developers established the first industrial park called "Eastern Industrial zone" 37 kilometers to the east of Addis Ababa, which includes different warehouses, shops, and factories. India's FDI concentrated on food processing and plastics. Investment from Italy is dominated by clothing and textiles, leather and engineering and metals. FDI from Saudi Arabia is dominated by food processing and clothing and textiles, although there are activities in other areas too. The Turkish company AYKA, which is the largest textile investor in SSA, is expanding with current employment of more than 8,000 workers. In the leather sector Pittards Tannery, a United Kingdom firm, and German footwear manufacturer Ara AG were also among the foreign firms that have invested in Ethiopia (UNCTAD, 2011).

There has been evidence of significant change over recent periods. For example, in 2008–2013, Chen *et al.* (2015) indicated that the manufacturing sector received the largest (76%) share of the total foreign investment, reaching US$2.2 billion. There were 920 operational projects in this period either fully owned by foreigners or a joint venture. Besides, the average size of manufacturing projects has been the largest, almost double than that of agriculture projects. In terms of sectoral composition, the largest and fastest growing were textile and clothing, and leather and footwear subsectors followed by food and beverage. In terms of numbers, the top five investors are from China (196 fully owned by Chinese), India (64), Turkey (57), Sudan (54), and the USA (45). In terms of capital, the top five countries are Turkey (US$967 million), China (US$545 million), Saudi Arabia (US$279 million), India (US$254 million), and France (US$96 million). Considering all types of jobs, the largest job creation (54%) by FDI has been in the agricultural sector followed by manufacturing. However, if only permanent jobs are examined, manufacturing becomes the top job creator, accounting for 60% of the total permanent jobs created (Chen *et al.*, 2015).

2.4.2.4 Capacity building for learning and innovation

The inferior competitiveness of the Ethiopian manufacturing sector was mainly because of low labor and total factor productivity (World Bank, 2009). Defined in its broad perspective as any production of new product and or new process and minor improvement in product, process, or work organization, innovation is the main source of productivity difference among firms. Low innovation capability is one of the major distinctive characters of manufacturing firms in SSA countries (UNIDO and GTZ, 2008). Strong technical and innovation capabilities are crucial not only for increasing productivity but also for attracting FDI and searching foreign customers for exporters.

In its first investment and innovation policy review (IPR), UNCTAD (2002) identified the major constraints against investment and innovation to be the form of business ownership and lack of supportive mechanism in Ethiopia. Rodrik's (2006) policy diagnostic model, presented in the previous chapter, can explain this better where all problems are categorized under low return to economic activities and high cost of finance. A high proportion of the private enterprises are sole proprietorships or family owned, which has implications for investment, innovative capability-building, and the implementation of industrial policy in general. The first implication of this pattern of ownership has to do with risk-averse behavior of the owners. Second, the decision-making power in sole proprietorship and family-owned companies tends to be highly centralized, usually in the hands of a single owner. The owners' perceptions of policy intentions and market conditions have impacts on the effectiveness of policy measures. Underlining the importance of forming collaboration between local and foreign companies, the IPR report presented details of several cases where local entrepreneurs faced problems to get the kinds of collaborations they needed with foreign companies. The report explained the extreme luck of knowledge the entrepreneurs had with regard to the negotiation process and the minimum technical capability the potential foreign partner expects from its local counterpart, as well as the costs involved in the process due to multiplicity of contacts and trips. Then the report indicated the pressing importance of setting the required government supportive mechanism to help firms seeking partners from abroad.

Building innovation capability requires active coordination by a government to put the fundamental conditions in place for an effective learning process. In addition to strategies aimed at attracting FDI and the incentive measures for export-oriented sectors, the Ethiopian government has also taken direct measures to facilitate learning process to build the required innovation capability. It is worth taking specific cases of textile and leather sectors in capacity building schemes (as presented in Gebreeyesus, 2013), which seem to apply IPR's recommendation. The two respective capacity-building institutes erected to support, coordinate, and guide the private sector are the Textile Industry Development Institute (TIDI) and the Leather Industry Development Institute (LIDI). Under the guidance of these institutions, special training centers called Leather and Leather Products Technology Institute (ELLPTI) and Textile and Apparel Institute (TAI) were established. In addition to this, the government introduced capacity-building initiatives such as benchmarking, institutional twining, and kaizen. These are worth elaborating due to their potential in capability building and knowledge transfer.

Benchmarking is the program launched in 2009 aimed at boosting the competitiveness of priority sectors through technology upgrading and capacity building. This program particularly targeted both public and private-owned textile and leather enterprises. Selected enterprises were planned to be offered direct and all-round support from internationally frontier firms under the sponsorship of the Ethiopian government. Accordingly, 7 textile, 10 garment, 11 leather products, and 9 shoe manufacturing enterprises were selected. Strict follow-up and monitoring of the implementation of this program was done through the two responsible government institutes (TIDI and LIDI) and the National Export Promotion Council.

Twining programs were designed to establish a long-term knowledge and experience-sharing scheme between TIDI and LIDI as well as other selected frontier similar international and local institutes to enable the former to build their service provision capacity. A network was planned to be established between LIDI, engineering capacity building, and selected similar foreign institutes in the leather subsector. Based on this, LIDI partnered (in 2011) with two Indian government institutions, the Central Leather Research Institute (CLRI) and the Footwear Design and Development Institute (FDDI) to improve its technological knowledge of the leather industry. In this partnership, 11 Ethiopian tanneries hosted three or four Indian leather experts for one year to help improve industrial practices. In relation to this, it is worth mentioning the improved performance of the Ethiopian footwear industry upon introducing new or improved enterprise management together with targeted technical assistance (Dinh *et al.*, 2012).Similar networking was planned between TIDI and other renowned international institutes in the textile sector (Gebreeyesus, 2013).

Kaizen was introduced in 2009 as part of a comprehensive approach to learning on the industrial development program by JICA in response to the request from the late Prime Minister Meles Zenawi (Shimada, 2013). It was aimed at supporting the development of private firms (a project for quality and productivity improvement). The project was started on 28 selected pilot private firms from agro-processing, chemical, metal, leather, and textile industries. Assessment of the impact of the project by a team of JICA and Ethiopian experts on the pilot firms shows substantial benefit in terms of both financial return and productivity. The average financial benefit earned by the 28 firms amounted to Birr 500,000 (equivalent to around US$30,030), while labor productivity of the firms improved by 50 percent. These and other improved methods of operations through kaizen were reported to have been achieved by conducting 5S activities (the work place organization method) and reducing seven types of waste (overproduction, inventory, repairs/rejection, motion, processing, waiting, and transport) (Shimada, 2013).

2.4.3. THE STRUCTURE AND PERFORMANCE OF THE MANUFACTURING SECTOR

2.4.3.1 Structure of the manufacturing sector

The industry and size structure of the Ethiopian manufacturing sector reveal the dominance of low technology and consumer goods-oriented industries with large proportions of small enterprises (Shiferaw, 2007).The formal manufacturing sector in Ethiopia is dominated by large and medium manufacturing (LMM) firms, which are smaller compared to those in other developing countries (Söderbom, 2011). The manufacturing sector has been growing over the last decade in value terms at similar rates as the growth of GDP. The number of firms, which was about 739 in 2000, increased to 2170 in 2011 (CSA, 2012). Employment in LMM increased from 124,554 in 2007 to 173,397 in 2011. In terms of location, more than 75% of the manufacturing companies are located within the periphery of the capital, Addis Ababa, due to historical factors, available infrastructure, and market concentration (Oqubay, 2015).

The major industrial categories in Ethiopia are manufacturing of foods and beverages, tobacco, textile, wearing apparel, leather and products of leather, wood products, paper products, chemicals, rubber and plastic, other non-metallic minerals, basic iron and steel, fabricated metal, machinery and equipment, motor vehicles, trailers and semi-trailer, and furniture. Series of annual reports by CSA indicate that the LMM sector is dominated by food products and beverages. In 2011, for instance, the sector accounted more than 31% of the LMM followed by non-metallic mineral products and the furniture industry which accounted for about 18% and 13%, respectively. On the other extreme, manufacture of machinery and equipment and manufacture of motor vehicles, trailers and semi-trailer each made only about 0.3% of the total.

When we look at the ownership structure of the manufacturing sector, we find public enterprises, endowment-owned firms, and private firms. The first category includes SOEs found in almost every sector. They are larger in size but smaller in number in their respective sectors. The distinction between endowment-owned and SOEs is absurd in the Ethiopian context. Endowment-owned enterprises belong to member parties of EPRDF. Private enterprises are those owned by individual domestic entrepreneurs, Ethiopian Diasporas, and foreigners. According to Altenburg (2010), all tanneries and garment producers and the majority of footwear and textile companies belong to private Ethiopian entrepreneurs. Over the last decade, private enterprises dominate the manufacturing sector, which appears to be encouraging for improved competitiveness of the sector and employment.

However, the overall share of the manufacturing sector remains small in terms of its contribution to GDP sharing the characteristics of firms in most African countries. Between 2002 and 2011, manufacturing contributed, on average, only about 5% to GDP out of which the mean share of large and medium size firms was 3.5%, while small and cottage industries accounted for the remaining 1.5% (MoFED, 2011). Increased share of employment, value added, and export earnings of the manufacturing sector in a given economy are among the common characteristics of industrialization, which does not seem to be happening in Ethiopia. The performance of the manufacturing sector is poor not only in terms of its contribution to GDP, but also in terms of export earnings as compared to similar countries in SSA. The following subsections depict these facts.

2.4.3.2 Value addition

Value addition is the distinctive characteristic of the manufacturing sector compared to other economic sectors. It involves sourcing of various inputs from both local and foreign markets to be produce products at different level. The medium and large manufacturing sector in Ethiopia heavily depends on imported raw materials mainly due to supply constraints from the local economy. CSA (2012) reported that the overall average proportion of imported input in total inputs has been about 0.50 until 2011 while the extent varies with sector. It varies from about 0.20 in other non-metallic mineral products and in leather and leather products to .99 in manufacture of basic iron and steel. The overall value added by manufacturing jumped from 5 million Birr in 2007 to 25 million Birr in 2011. Industry wise, the highest value added (40%) was observed in manufacturing of metal products followed by textile and wearing apparel (35%). However, the manufacturing value added in GDP remained low.

Figure 2.18(a) reveals trends in the contribution of the manufacturing sector in GDP of Ethiopia along with that of Kenya, Tanzania, and Uganda. As can be seen from the figure, Kenya is at the top with its manufacturing, making more than 10% of the country's GDP in the 1990–2011 periods. Tanzania and Uganda assume the second and third positions, respectively, accounting for 5–10% of GDP. The mean contribution of the Ethiopia's manufacturing over 1990–2011 was less than 5% indicating the poor performance of the sector compared to the three east African countries. In terms of growth in the manufacturing value added, Ethiopia experienced negative growth for three years immediately after the economic reform (1990–1992). The highest growth was seen in 1993 after which it started to show stable growth similar to the comparators (panel b of figure 2.18).From 1990 to 1999, Uganda had registered the highest growth in the manufacturing value added while Kenya had experienced relatively lower growth. After 2000, there has not been discernible difference among these countries in manufacturing growth while there seems to be incidences of better performance in Ethiopia on the one hand and least performance of Kenya on the other.

(a) (b)

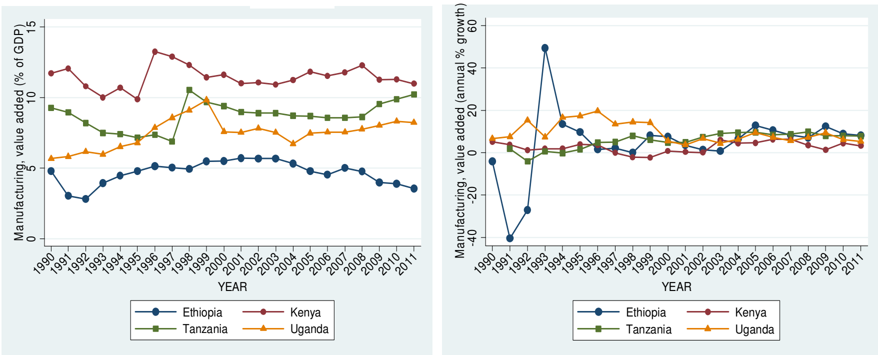

Figure 2.18 Manufacturing value added as % of GDP and its growth
Source: Computed based on ADI data base

2.4.3.3 **Shares of manufactured export**

For most of the successful East Asian, South East Asian, Latin American, and the Asian Tigers, export promotion played a critical role in long-run growth by creating a virtuous circle of investment, innovation, and poverty reduction. Most of those countries have transformed their economies from dependence on primary products to becoming important manufactured exporters (UNCTAD, 2008). Benchmarking, specifically, Taiwan and Korea, Ethiopia prioritized and arranged incentive mechanism for export-oriented industries. The need to generate foreign exchange and the limited size of the domestic market are among the major justifications for export orientation. UNIDO and GIZ (2008) also described the crucial importance of export orientation for SSA firms to benefit from positive spillovers following contact with firms and suppliers from developed economies. Similarly, Sutton and Kellow (2010) emphasized the potential for technological learning from export participation. However, the export performance of the SSA counties has been very low (Dinh *et al.*, 2012). Ethiopia's export target has not been met not only for overall manufacturing sector but also with respect to the priority sectors (Sutton and Kellow, 2010; Gebreeyesus, 2013). Figure 2.19 displays trends of the manufacturing export in 1992–2011.

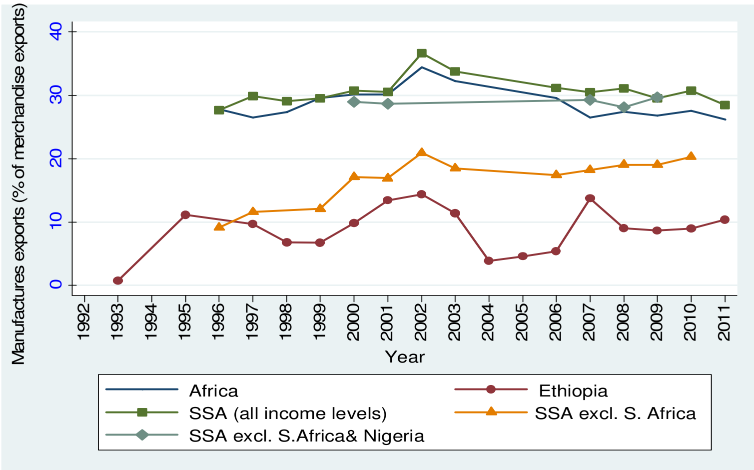

Figure 2.19 Manufacturing export as percent of merchandize
Source: ADI, 2013 database

The graph (Figure 2.19) shows that the percentage of manufacturing from total merchandize export had improved after 1993 following the economic reform Ethiopia undergone during the transition period. It had shown a remarkable increase (exceeded 10%) from 1999 until 2002. Then it decreased to its lowest value in 2003 and then jumped again in 2007 before it shrunk down during the global financial crisis. As compared to the aggregate value of SSA and all African countries, Ethiopia had far lower manufactured export over the whole period. This could be partly explained due to the fact that Ethiopia is a landlocked and resource-poor country. If we look at the sectoral composition of the manufactured export, we can see the role of sectors selected in the government plan. The following table shows the contribution of top 5 export sector based on two-digit international industrial classification (rev-3.1).

As can be seen from Table 2.13, in 1996, leather was the first most important export item followed by manufacture of other transport equipment (namely aircraft and space craft) and food products respectively. Textile was only fifth during that period.

In 2003, food products had taken the lead in manufactured export with about 42% of total manufactured export while leather and textile ranked second and fourth, respectively. After a decline in the export of leather products between 2003 and 2010 due to the government decision to add more value to final product, leather and leather products ranked first in 2011. Food and beverage and textile products were the second and third most important manufactured exports during the same period. This indicates that the three prioritized sectors in the government plan had started to take the lead in the manufactured export.

Product	**1996**		**2003**		**2011**	
	Share (%)	rank	Share (%)	rank	Share (%)	rank
Leather and leather products	26.13	1	22.74	2	37.22	1
Other transport equipment	24.11	2	14.59	3	7.43	5
Food and beverage	23.69	3	41.74	1	18.61	2
Instruments and appliances	16.78	4				
Textiles	2.1	5	7.8	4	17.66	3
Wearing apparel					7.79	4
Machinery and equipment n.e.c.			1.6	5		
Sub-total	92.81		88.47		88.71	
Others	7.19		11.53		11.29	
Total	100		100		100	
Total export (million US$)	**119.97**		**127.28**		**327.19**	

Table 2.13 Sectoral composition of manufactured export (% of
Source: Recomputed based on Gebreeyesus, 2013

2.4.3.4 Productivity

The World Bank (2015b) underlined that productivity gains are key for long-term economic growth and improvement in living standards and one of the key dimensions in which Ethiopia has to transform its economy to realize the GTP goals of reducing poverty and becoming a middle-income country within a decade. It particularly focused on the need for increased productivity and competitiveness of the industrial sector for rapid and sustained job creation (GTP pillar 3). As indicated earlier, the government's effort lies in helping develop a competitive manufacturing sector that would lead the desired structural transformation by exploiting the country's potential in terms of resource and cheap labor. The latter makes Ethiopian firms more competitive than firms in SSA countries with better productivity (World Bank, 2015b).

Even though the sector is characterized by the dominance of traditional industries with labor-intensive nature, firms in Ethiopia are more capital intensive and have higher productivity of labor than firms in peer countries (World Bank, 2015b). However, in terms of productivity measures that take capital intensity into account such as capital productivity and total factor productivity (TFP), Ethiopian firms appeared to be less productive than those in peer countries. This fact suggests that the high labor productivity of Ethiopian firms may be due to substitution of capital for labor.

In today's increasing competition in a globalizing world, dynamic improvement in productivity is crucial for firm survival and growth in aggregate sectoral productivity. However, productivity hardly has improved in the case of the Ethiopian manufacturing firms. For instance, during 1992–2000, TFP of the manufacturing sector had been declining with some sector specificities where productivity grew for 3 years in a row in 1998–2000 for the textile and light machinery industries (Shiferaw, 2007). In his decomposition analysis, Shiferaw (2007) found that intra-firm productivity decline accounted for the highest proportion of the declining productivity at the industry level. However, reallocation of resources from less efficient to more productive incumbents has partly compensated for the declining sectoral productivity.

In recent years, the dynamics of TFP appears to be different from earlier years (1992–2000) and has significant variation with industry classification. Table 2.14 displays the average log values TFP of manufacturing firms in two-digit industries. The table shows that during both 2005 and 2011, manufacturing of textile registered the highest TFP. The least productive sector in 2005 was manufacture of fabricated metals while it was wood products in 2011.

In terms of growth, the textile industry was the highest with 18% changes followed by rubber and plastic (17%) between 2005 and 2011. Wearing apparel occupied the third place with a growth of 15%. Leather and foods and beverage have not shown any change during the same period while wood products, chemicals, fabricated metals, and furniture showed negative growth. The decline in average TFP has been the highest (39%) in the case of wood products. Despite its limitation for generalization, the above table shows that there is improvement in the productivity in both labor intensive (textile and wearing apparel) and capital intensive (machinery and equipment, motor vehicle and trailers) industries.

Industry	**2005**	**2011**	**%change (2005–2011)**
Foods and beverage	7.09	7.09	0
Textile	7.30	8.64	18
Wearing apparel	6.52	7.52	15
Leather	7.06	7.07	0.01
Wood products	6.66	4.08	-39
Paper products	7.27	7.51	3
Chemicals	7.12	6.84	-4
Rubber and plastic	6.54	7.64	17
Other non-metallic mineral	6.67	6.92	4
Basic iron and steel	7.14	7.20	1
Fabricated metal	6.45	6.39	-1
Machinery and equipment	6.56	7.20	10
Motor vehicles and trailers	6.58	7.12	8
Furniture	6.46	6.42	-1

Table 2.14 Average TFP of firms by industry group

Source: Author's computation from LMM data using Levinsohn & Petrin method

According to AACCSA (2015), the low productivity and hence low competitiveness of the manufacturing industry has been largely attributed to the use of obsolete machinery, lack of skilled manpower, and application of backward production technology. It was also indicated that manufacturing firms in Ethiopia were utilizing only 54.3% of their production capacity. Average capacity utilization of agro-processing, textile, pharmaceutical industries, and leather in 2009/10 were reported to be60%, 40%, 30%, and 10%, respectively.

From the above discussion, it generally appears that the impact of most of the government's efforts seems to be negligible. This indicates the need to work harder both at the firm level and national level toward successful achievement of the aspired structural change.

2.5. SUMMARY

Ethiopia is the second largest populated country in Africa and among the poorest countries in the world. The performance of the economy has changed over years following regime changes and the corresponding economic system. The 1991 economic reform by the EPRDF government marked significant changes in the development of the private sectors. The national development plans over the last two decades targeted poverty eradication and job creation by accelerating economic transformation. The recent Growth and Transformation Plan (GTP), particularly, envisaged changing the economy from agriculture to industry and achieving the status of a middle-income country by 2025. Developing the manufacturing sub-sector has been the core area of emphasis and various incentive measures have been taken in an effort to develop this sector. This effort seems to pursue the argument that during the early stages of industrial development, the movement from agriculture to manufacturing tends to benefit the poor. The corresponding justification is based on the fact that the manufacturing sector utilizes predominantly unskilled and semi-skilled labor and its greater potential for aggregate productivity growth (World Bank, 2014).

However, the pace of structural transformation has not been good enough to realize the objectives. The two sectors—services and agriculture—have been the backbone of the economy. The share of manufacturing in GDP has been stable, constituting about 4.4%of GDP in 2014 with a growth rate of 11%, which is far below the 22% growth target of the GTP (World Bank, 2015b). The industrial sector has registered the largest growth (19%) not because of manufacturing but due to the boom in the construction and mining sectors. There has been no significant improvement in the volume and diversity of export products. Agricultural products are still the main source of export earnings with no sizable progress in manufacturing export constituting only about 10% of total merchandize export. The agriculture sector remained the largest employer with an increasing share of the service sector in recent years. There is no movement of labor from low productivity growth to high productivity sector, which marks the country's failure in structural transformation (McMillan and Rodrik, 2011).

Despite the slow progress that have been made, the Ethiopian government has maintained its ambitious plan of making the country a manufacturing powerhouse with a special focus on light manufacturing for employment generation and becoming a middle-income country by 2025. The second Growth and Transformation Plan (GTP II) has already been prepared and ready for implementation between 2015/16 and 2020/21. This plan has also placed its focus on structural transformation that would help shift the economy from agriculture oriented to manufacturing based. The extent to which this new plan will be achieved could be conditioned, partly, by the success and failure experiences during the implementation of the previous plan.

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CHAPTER 3. THEORETICAL FRAMEWORK AND METHODOLOGY

3.1. INTRODUCTION

Today, countries in the south are striving against complicated situations and in a stronger policy dilemma to improve the wellbeing of their people. The growing pace of liberalization and globalization allow some developing countries to cope well, while the majorities fail (Lall, 2006). In this dynamic world, it has not been an easy task for scholars to trace particular reasons for why some countries progress while others do not. Given the rising technological progress, globalization, and heterogeneity of country-specific characteristics, the scholarly intellect could not develop a perfect formula for each country contexts and help respective policymakers to ease their dilemma. However, evidences suggest that successful development of the industrial sector is one visible fact that explains differences between less developed and developed countries. Such evidence is supported by the early work of Fredrik List (cited in Freeman, 1995), which advocates policies that would facilitate learning new technologies and applying the technologies toward accelerated industrialization and economic growth. Indeed, whether or not a country benefits from globalization depends mainly on its capacity to absorb or learn new technologies (Katz, 2006).

Catch-up theorists (Gerschenkron, 1962; Abramovitz, 1986; Reinert, 2010) indicated that technological progress and globalization can benefit latecomers if they can turn their backwardness into an advantage by borrowing or adapting technologies that have already matured in richer economies. In support to this theory, Lin (2011) argued that with the current tendency of re-localization of manufacturing activities, developing countries have the potential to achieve a rate of technological innovation much higher than that of advanced countries. According to him, these countries better work in line with their respective comparative advantage. This seems to be true for a country that starts the journey of industrialization. However, it is also important to build new capabilities even against comparative advantage if it is believed that the new capability involves strategic importance as was done by Japan, Korea, and China (Rodrik, 2011a). The knowledge of where the comparative advantage of a country lies and what potential capability could exist in the country requires continuous examination. Particularly, it is important to know how firms react to changes and what supportive environment would help develop the exiting potential capabilities. Frischtak (2006) indicated that the main focus of research on learning and technological capability building is to shed light on how firms respond to and interact with economic institutions and incentives under the pressures of global competition. The current thesis aims to examine how firms in the Ethiopian manufacturing are affected by the dynamics of the global competition.

This chapter of the thesis presents alternative theories relevant to back the empirical chapters (Chapters 4, 5, and 6) of the thesis from macro and microeconomic perspectives. It begins with an effort to illuminate the crucial roles that the industrial sector, in general, and the manufacturing sector, in particular plays in the long-term sustained growth of an economy. Then it goes on to establish an argument for the strategic importance of building learning capability for diffusion and transfer of technology, which is critical to generate high performance of firms, especially, in less developed countries. High learning capability confers firms with better absorptive capacity that would enable adoption, adaptation, and diffusion of modern technologies, which would ultimately help develop their innovation capability. Theories from both micro and macroeconomic perspectives place innovation at the center of sustained economic growth in general and the development of the manufacturing sector in particular. The theoretical framework of firm-level analysis will be elaborated and translated into simple demonstrative models that are believed to suit Ethiopian context.

In simple terms, this chapter is a conduit for theories that link and support the three empirical chapters listed above and the prevailing industrial policy stance in Ethiopia. Accordingly, the chapter begins by presenting an overview of some growth theories in Section 3.2. Section 3.3 discusses theories related to structural change and industrialization. In Section 3.4, we will explain alternative ways of international technology transfer with focus on trade and FDI-related channels. Section 3.5 elaborates the key role of technological capability in the process of industrialization. Section 3.6 explains the relevant theoretical bases and builds the model of firm-level learning. The last section elaborates the data and methodologies applied in the empirical analyses based on the theoretical models.

3.2. OVERVIEW OF SOME THEORIES ON ECONOMIC GROWTH

Growth theories (Solow, 1957; Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1998) recognized the significant role of technology and innovation in economic growth. Similarly, Schumpeter (1942) described technological innovation as the vehicle for economic progress while associating its decline with lack of innovation. Unified growth theory (Galor, 2005) also associates successful transition of economies with the interplay between human capital development and technological progress. In the neoclassical model, factor accumulation and exogenous technological progress are the major determinants of growth. Easterly and Levine (2001) noted that growing body of literature on growth associated cross-country differences in the level and growth rate of GDP per capita with "something else" beyond the accumulation of physical and human capitals. This “something else” was typically referred to as total factor productivity (TFP), which is traditionally interpreted as technological progress. However, the question of how to reduce the productivity gap between developed and less developed countries has remained a key concern for the economics profession (Katz, 2006) apart from some theoretical explanations.

Traditional economic theories that explain the possibility of convergence between less-developed and developed countries can be generally categorized into two. The first category (Solow, 1956; Barro and Sala-i-Martin, 1992, 1997) associates convergence with decreasing returns in physical or human capital accumulation of the countries. Particularly, this approach presumes that countries that are poorer and have higher marginal productivity of capital should grow faster in the transition to the long-run steady state (Barro and Sala-I-Martin, 1997). The second category that mainly belongs to endogenous growth theories (Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1998) explains economic convergence as a result, primarily, of cross-country knowledge spillovers. Discoveries in the technologically leading economies are the driving force for the long-term growth of the world economy whereby followers converge toward the leaders through imitation as it involves less cost than innovations. In this approach, the innovation capabilities of a sector or a country (less developed) advances through transfer of knowledge created in another sector or country (developed) (Aghion and Jaravel, 2015).

However, countries exhibit differential capacity to imitate and adopt foreign technologies. The quality of a country's human capital is crucial for successful diffusion of technologies. According to Heitger (1993), a backward economy with a relatively better human capital endowment relative to the already achieved level of development will have more capacity to absorb foreign technologies than countries with less endowment. Similarly, a developing country with a better stock of capital and more effort in new investment will enjoy more benefits in technology adaptation possibility than a country at a similar stage but with less stock of capital and investment. This justifies why absorptive capacity is a key point of discussion while talking about cross-country convergence or divergence as well as in the debate on appropriate growth policies (Aghion and Jaravel, 2015*)*.

Evolutionary theory (Nelson, 1981; Nelson and Winter, 1982) and neo-Schumpeterian economics view technological advancement as the central driving force of growth. Moreover, Nelson (1981) noted that if the analysis of growth is to proceed in a context of strong interaction among factors, it is essential to focus on the key processes involved and try to see the role of the various factors in these processes. He proposed, also, that reallocation of resources should be seen as a key process in productivity growth, which determines the pace at which potentialities opened by new technology can be exploited. Resource reallocation would simply reflect differences in income elasticities of demand among products. But it reflects even more than this due to the fact that technological advancement destroys the economic viability of certain industries, firms, and jobs, as it creates new ones (Schumpeter, 1942). Within this context of growth driven by technological advance, and involving significant resource reallocation, capital and education play key supporting roles (Nelson, 1981). Dosi and Nelson (2010) noted that with both their secular increase in percapita productivity and incomes and their fluctuations and discontinuities, the growth patterns of modern economies are deeply shaped by the underlying patterns of technological and organizational evolution.

Theoretically, there is an opportunity for technologically backward countries to grow at a faster rate than more advanced countries. This is what some theorists (Abramovitz, 1986; Veblen, 1915) call economic catch-up. In reality, there were large technological differences between rich and poor countries, and engaging in technological catch-up was probably the most promising way that poor countries could follow the path to achieving long-term growth (Gerschenkron, 1962). However, catching-up with technological leaders is not an easy task. The time a country takes to catch-up depends on factors limiting technology diffusion, the pace of structural change, the rate of capital accumulation, social capabilities, and the prospect of market demand (Abramovitz, 1986). Abramovitz (1994) pointed out some of the aspects that are particularly relevant in social capital, such as technical competence, experience in the organization and management of large-scale enterprises, financial institutions and markets capable of mobilizing capital on a large scale, honesty and trust, the stability of government and its effectiveness in defining rules, and supporting economic growth.

From above ground, there seems to be a consensus between orthodox and heterodox theories regarding the role of technological progress in explaining differences in the economic growth of countries. However, orthodox theories failed short of explaining the actual growth processes owing to some of the assumptions inherent in their modeling. Particularly, the assumptions built into the simple form of the neoclassical model that technological knowledge is a public good and that growth is an equilibrium process appear to be at odds with the mechanisms through which new technologies evolve in capitalist economies. Besides, technology is not freely available as a public good as it is assumed in neoclassical theories. The growing rate of technological change and complexity increases the information needs of industrial policy. Markets for skill, capital, and infrastructure have to be functional and there is a need to coordinate learning across enterprises and activities. Leaving capability building to free market forces, following neo-liberalism, can result in sluggish and truncated technological development where latecomers would remain far behind the frontiers. Market forces are incapable of getting latecomers out of low-growth trap given the rapid change in technologies and the path dependency nature of capability building (Lall, 2006).

In contrast to neoclassical theories, evolutionary economics sees development as a process of qualitative change in historical time, driven by firms, governments, and other organizations with diverse sets of motivations, decision rules, and capabilities rather than optimizing behavior and perfect information. Neo-Schumpeterian theories also suggest that growth rests on endogenous profit-driven knowledge accumulation and diffusion (Ertur and Koch, 2011) conditioned by the institutional and economic environment. Hence, successful transformation of a given economy depends on the country's effort in improving the stock of its technology, proper reallocation of factors, and innovation (UNCTAD, 2012) along with investments required to implement new technologies. The ultimate impact of any technology is raising the productivity of economic resources. Proper resource allocation refers to moving resources from economic units with less productivity to those with more productivity within a given economy. This is particularly termed as structural change. Similar to technologies, "appropriate" structural change is a crucial source of improving aggregate productivity. Evolutionary economics appreciates the role of structural change in determining aggregate productivity driven by competitive selection and reallocation of factors among economic sectors.

However, the type of structural change that would result in superior productivity depends on the nature and level of a country's development. At sector level, the industrial sector is often assumed to exhibit greater productivity and hence tendency to shift more resources toward it, mainly by low income countries. The following section provides some theoretical discussions on this issue.

3.3. STRUCTURAL CHANGE AND INDUSTRIALIZATION

Here, we will present a brief theoretical justification for the desired type of structural change along with the dynamics of the industrial sector with a focus on the manufacturing sector. More importantly, this section would partly support the general theoretical basis of Chapter 4, which deals with the growth and survival of firms. Growth, entry, and exit are among the key factors in determining structural changes happening both within the manufacturing sector and in the overall economy.

3.3.1. STRUCTURAL CHANGE

In its broader sense, structural change refers to the dynamics in the share of the three main economic sectors (agriculture, industry, and service) in a given economy. In the context of less-developed countries, structural change is considered to play a key role in raising aggregate productivity and employment thereby reducing poverty (Duarte and Restuccia, 2010; AfDB *et al.*, 2013). Particularly, countries aspire to see changes that shift their economies toward more processing or value adding industry, such that the share of industry and manufacturing increases, labor productivity grows, and economies reduce their dependence on developed countries (Tuma, 1987). Development economics literature shows that industrialized countries have also evolved through similar structural changes where agriculture had dominated their economies at the early stage of their development. This has been observed especially during the 1950s and 1960s in southern Europe, and since the 1960s in East and Southeast Asia (Rodrick, 2011b). As a given economy undergoes progress, the industrial sector replaces the dominance of agriculture, in terms of both employment and output, until it begins to leave position to the service sector as the economy advances further.

Taking economic development as a process of structural change, many development economists (Kuznets, 1967; Pasinetti, 1981; Thirlwall, 2002; Rodrik, 2008; Reinert, 2010; Chang, 2003) believe that industrial development and development of the manufacturing sector, in particular, is the prime driver of economic transformation and productivity growth. The empirical evidences that associate significantly increasing technological progress with industrialization (Galor, 2005; Lall, 2006; Lin and Chang, 2009) suggest the crucial role of industrial sector in the process of economic transformation. Tuma (1987) also noted that economic growth depends on the development of a country's industries and the capacity to sustain their competitiveness by means of enhancing the productivity of labor and capital. Due to the fact that high levels of manufacturing productivity are associated with higher capital and labor productivities, successful growth of a given economy is characterized by improved pace of industrialization (Dosi et al., 1990).

The theoretical models that explain why one may expect the aforementioned type of structural change have been reviewed and well presented in Acemoglu (2009: 697) using tractable mathematical models. He presented models that help explain differences in the growth of sectors from two different perspectives under the title "nonbalanced growth" models. The first is from the "demand side" (preference-related) perspective which was claimed to have originated from Kongsamut, Rebelo, and Xie's extension of Engel's law which states that as a household's income increases, the fraction that it spends on food (agricultural products) declines. According to the law, as a household becomes richer, not only does its spending on food declines, its expenditure on services also increases. The intuition behind this model is that, as a given economy advances, households' demand for agricultural products declines while that of non-agricultural sector increases leading to more growth in the later sector in terms of both output and employment.

The second is from the "supply-side" (technology related) perspective, which Acemoglu (2009) indicated to have originated from Baumol's work that characterized uneven growth as a general feature of the growth process in relation to differences in the growth rates of different sectors, which is mainly driven by differences in technology. This perspective meets with the contributions of Kuznets (1967) and Thirlwall (2002), which associate differences in the growth rates of sectors with differences in the rates of technological progress. It means that, if the industrial sector is seen to grow faster than service and agriculture, it is due to better advancement of its technologies. For instance, due to the advancement of radical innovations in the information and communication technology (ICT), the service sector has become a key sector for countries like India.

This suggests the fact that structural change may not necessarily follow the traditional model of economic dynamics that involves shifting focus from agriculture to industry and from industry to service. There could be the possibility for the economic importance of sectors to jump from agriculture to service sector. There is some empirical evidence in favor of this. For instance, using data from newly industrializing economies in Europe and Asia, developed countries in Europe, and developing countries in Asia, Fagerberg and Versbagen (2002) showed that the manufacturing sector has lost its position to the service sector as an engine of growth by virtue of constituting the most progressive technologies of the day. On the other hand, they noted that this advancement in ICT partly worsened the existing difficulties in technology diffusion, which requires high human skills and related capabilities. The fact that following service led growth requires highly developed human capital and related infrastructure weakens the arguments in favor suggesting other less-developed countries (LDCs) to follow the Indian model of structural change toward accelerating economic growth.

In the case of African countries in particular, AfDB *et al*. (2013) indicated that advising Africans to direct focus toward services is misleading for two main reasons. First and foremost, the business service sector that constitutes India's success is the one that require high levels of education, which remains a relatively scarce form of human capital in most African countries. Second, this sector directly employs negligible proportion (around 2%) of India's labor force. Therefore, achieving broad-based growth on the basis of business services sectors in Africa does not seem to be realistic, except, potentially, for small countries such as Mauritius or Botswana who relatively own a well-educated labor force (AfDB *et al*., 2013).

There are also other policy advices that recommend Africans develop their economies based upon carefully managed mineral and agricultural sectors rather than emulating broad industrial evolution that took place in America and Western Europe during the nineteenth century or the one observed in East Asia in the late twentieth century (Asche *et al.*, 2012). This type of policy advice stems from classical comparative advantage theory and recommends that Africa concentrate on exploiting the advantage from land, labor, or resource factor endowment. However, this idea does not match well with the dynamics of the world trade and advancement in technologies. Instead, the second school of advice that recommends increased participation in a broad range of global value chains (GVC) seems to be more plausible. This involves starting with natural resource extraction and agro-industry while simultaneously searching for specific tasks within manufacturing GVCs to create more downstream value added in African countries (Asche *et al.*, 2012). Moreover, the fact that manufacturing industries produce tradable goods allowed for fast integration into global production networks, which in turn accelerate the transfer and diffusion of technologies.

This is in line with the classic argument that manufacturing is a more dynamic sector as it has the highest potential in creating both upstream and downstream linkages in the production system. These linkages, and the streams of information connected to them, support interactive learning and innovation which are crucial for economic growth. In the process of industrialization, the manufacturing sector is considered not only as the major source of technological change, but also the primary field of economic application of the technical change (Dosi *et al.*, 1990, 2008). In addition to this, manufacturing holds the potential of hiring large numbers of low-skilled workers and source of new capabilities (AfDB *et al.*, 2013). In relation to this, Rodrik (2012) indicated that manufacturing industries exhibit more rapid and unconditional convergence of productivity growth than the convergence of the aggregate productivity of countries. Alternatively, he argues that once a country successfully enters a given industry, the productivity levels of the industry will rapidly catch-up with the global technology frontier irrespective of the country itself. Indeed, developing countries with the most rapid growth rates and faster aggregate productivity catch-up were those that typically reallocated the greater proportion of labor into high-productivity manufacturing activities (Duarte and Restuccia, 2010).

Therefore, it is logical to justify why the manufacturing sector would be crucial in the process of structural transformation and productivity catching-up in LDCs. Given this evidence, it is worth discussing some theories on the dynamics of the industry. It is particularly important to look deeper into the process of structural change within the manufacturing sector too.

3.3.2. INDUSTRIAL EVOLUTION

In order to understand the dynamics of the manufacturing sector, it is helpful to examine the basic aspects of the evolution of the industrial sector. In this regard, Schumpeterian economists share four important views (Dosi *et al.*, 2008). They believe that innovation is a key driver of economic growth and to a good extent undertaken by business firms. Second, they have a clear belief in the heterogeneity of firms as a robust and persistent stylized fact, which holds across all sectors, regardless of the level of disaggregation. Third, as a consequence, all these works are at ease with the view that markets perform also as selective devices (or at least they are supposed to),eliminating the worst performers and promoting the best performing ones. Hence, decentralized processes of entry, differential growth, and exit give the micro-foundations of productivity and growth in output at higher levels of aggregation. Fourth, the foregoing Schumpeterian “micro-foundations” are quite complementary with a “Kuznetsian” dynamics in which diverse sectors and activities change their relative contribution in the overall economy, while some new ones enter and some others disappear (Dosi *et al.*, 2008).

According to Dosi and Nelson (2010), the identification of different patterns of industrial evolution conditional on specific regimes of technological learning has been a useful area of investigation over the last two decades. They used the word "regimes" to represent distinct ensembles of technological paradigms with their specific learning modes and equally specific sources of technological knowledge. Dosi and Nelson (2010) cited the sectoral classification of Pavitt (1984) as a useful starting point to capture the relations mapping "industry types" and industry dynamics. In view of the current study, such classification provides theoretical ground for the type of learning exercised by firms in less developed countries. Pavitt's taxonomy identifies the following four categories of sectors.

i) "supplier dominated," sectors whose innovative opportunities mostly come through the acquisition of new pieces of machinery and new intermediate inputs (textile, clothing, and metal products belong to this category);
ii) "specialized suppliers," including producers of industrial machinery and equipment;
iii) "scale-intensive" sectors, wherein the sheer scale of production influence the ability to exploit innovative opportunities partly endogenously generated and partly stemming from science based inputs;
iv) "science-based" industries, whose innovative opportunities co-evolve, especially in the early stage of their life with advances in pure and applied sciences (microelectronics, informatics, drugs, and bioengineering are good examples).

Dosi and Nelson (2010) argued that Pavitt's taxonomic exercises are important in that they identify discretely different modes through which innovation occurs in contemporary economies. Moreover, they are important because they allow a link between such modes of innovative learning, the underlying sources of knowledge, the major actors responsible for innovative efforts, and the resulting forms of industrial organization. This can be depicted in terms of a specific form of economic evolution. Holm (2014) defined economic evolution as "an open-ended process of novelty generation and the reallocation of resources." He indicated that economic evolution constitutes four major components as depicted in the following stylized equation.

$$Evolution = Selection + Learning + Entry + Exit$$

In this stylized representation of economic evolution, selection is the primary component and it is one of the pillars of industrial evolution of any type (Dosi *et al.*, 2008). It is the sorting of a population of economic agents implicit to their differential growth rates. Selection involves competitive interaction among heterogeneous agents leading to differential growth and differential survival probabilities (Metcalfe, 1998; Dosi *et al.*, 2008; Dosi and Nelson, 2010). Taking firms as economic agents and productivity as a driver of evolution, productivity evolution in a population of firms was shown to constitute the sum of two effects. These are the inter-firm or reallocation (selection effect) and the intra-firm (learning or innovation) effect. At higher aggregation of industry, the selection term of the above equation can also be decomposed into inter-industry selection and intra-industry (inter-firm) selection. Inter-industry selection is often referred to the process of structural change, while inter-firm selection is driven by the process of competition (Holm, 2014). This implies that learning and innovation can also facilitate structural change by affecting the selection process.

According to Holm (2014), it is important to include entry and exit to the above equation despite the fact that their effects can also be interpreted in terms of the first two terms. Specifically, since entry is the introduction of new knowledge by entrepreneurs and exit is the vanishing of an inferior firm, these effects are also learning and selection. This implies that industrial evolution is driven by the combined effect of selection and learning or innovation. Similarly, Dosi *et al.* (2008) noted that distinctive learning and innovation are among the pillars of the theory of industrial evolution of any type. Similarly, Malerba (2006) described innovation as a major factor affecting the growth and transformation of industries, and the rate of entry, survival, and growth of firms.

From the above discussion, it appears that technology and innovation are crucial for a given country's economic growth, in general, and structural change within the economy, in particular. However, the main driving forces of technological change vary from country to country, mainly, with the level of development of the countries. Due to the costly, risky, and path-dependency nature of R&D based creation of new technologies, the essential sources of innovation and learning for most countries around the globe, in general, and less developed countries (LDCs) in particular, are knowledge and technologies imported from abroad(Fu, Pietrobelli, and Soete, 2011). Therefore, it is the policies and institutions affecting international flows of equipment and services, human capital, and foreign investments, as well as the Global Value Chain (GVC) that matter (Pietrobelli and Rabellotti, 2011) for LDCs. Given this evidence, we will turn to elaborating the possible channels of acquiring foreign technologies.

3.4. INTERNATIONAL TECHNOLOGY TRANSFER

The importance of technology transfer between countries is growing with increasing openness of both developing and developed countries. Fu *et al.* (2011) described that the contemporary mode of innovation is increasingly becoming open and is characterized by greater use of external inputs. It is quite obvious that in most nations, only a small part of the total technical learning is really homemade while the majority of knowledge originates from abroad (Dalum *et al.*, 2010). Today's success in the Japanese economy had its foundation on the country's capability in copying, imitating, and importing foreign technology in the 1950s and 1960s (Freeman, 1995). To borrow and absorb technical knowledge developed and already used elsewhere often involves lesser efforts than to develop it from scratch. Due to the fact that the hardest work of developing new knowledge is already done abroad, technical learning in a given economy is relatively easy. This was the first part for the catching-up growth of Japan and the Western European countries toward the technology leading USA in the 1950s and 1960s (Dalum *et al.*, 2010). However, technology diffusion was not alone in explaining these countries' catching-up; the role of social capability and capital accumulation was also crucial (Abramovitz, 1994).

According to Pietrobelli (1996), there are various mechanisms through which technology diffuses between firms and across regions and countries, which include: movement of goods through international trade; movement of capital through inward and outward foreign direct investment (FDI and OFDI); movement of people through migration, travel, and foreign education of students and workers; international research collaboration; diffusion through media and internet of disembodied knowledge; and integration. Among these, international trade, FDI, and integration into global value chains are the most popular channels in regards to LDCs. Empirical evidences suggest that developing countries with successful export promotion policies and FDI-friendly climate have acquired more technologies irrespective of their industrial policy and hence registered better economic growth (Damooei and Tavakoli, 2006; Van Biesebrook, 2005; Zeng, 2006; Isakssen *et al.,* 2005). Therefore, we will briefly discuss the main channels as follows.

3.4.1. INTERNATIONAL TRADE AND TECHNOLOGY TRANSFER

International trade plays a key role in the economic growth of countries around the globe—a view equally shared by both traditional and modern economic theories. From a policy perspective, however, the extent to which a country should open its door for international competition has remained debatable, particularly for LDCs. This has been intensified with the growing impact of globalization. The adverse effect of globalization on poor economies has been traced to the neoliberal thinking embedded in the "Washington consensus" (Rodrik, 2006). Proponents of this thinking believe that the best strategy for all countries is to liberalize, and integrate their economies into the international economy. They suggested leaving allocation of resources to markets based on their assumption that international trade follows comparative advantage based on factor endowments only. By leaving resource allocation to the price mechanism, countries are expected to realize "natural" comparative advantage, optimize dynamic advantage, and achieve the highest growth. Of course, countries undergoing structural transformation are engaged in a continual process of creative destruction and integrating themselves into the global economies (Veugelers and Mrak, 2009; UNCTAD, 2012). Particularly those with high technological capability benefited the most (Lall, 2003, 2006). Contrary to this, poor countries are the most adversely affected in face of the growing competition among all countries (Lin, 2011).

Galor (2005) documented the asymmetrical role of international trade between industrialized and non-industrialized economies during the second phase of the industrial revolution. Trade enhanced specialization in the production of industrial and skill-intensive goods in industrialized countries. In contrast, it created incentive to specialize in the production of goods with less skill-intensive and non-industrial goods in economies dominated by traditional sectors. As a consequence, countries that produce products with high technological content have benefited greatly from globalization, while those producing less technological goods have faced adverse effects (Lall, 2006). In relation to this, policies prescribed to poor countries according to the "Washington consensus" have failed to produce the expected results (Rodrik, 2006) implying defects with the classical trade theory.

Therefore, a more plausible ground for international trade seems to be the one that posits technical change at the center of international competitiveness of a country or an industry. In relation to this, Lall (2003) argues that, with globalization, patterns of competitive advantage are changing as exports increase in response to two forces, namely *innovation* and *relocation* of activities, processes, or functions to lower cost areas. Both are observed in most industries, but their importance varies with technology and physical characteristics. Some products such as pharmaceuticals grow rapidly mainly because of innovation with little relocation to take advantage of low wages, whereas electronics and the like benefit from both innovation and relocation. Labor-intensive products such as apparel are motivated primarily by relocation in search for cheap labor (Lall, 2003). In agreement with this, Dosi *et al.* (1990) forwarded two important theoretical propositions. First, the micro-foundation of international trade should be based on the extension of an "evolutionary" interpretation to international arena. Second, evolutionary dynamics posits that comparative advantage is the outcome of the process of learning, innovation, imitation, and organizational change with country and sectoral specificities.

Nevertheless, there is no doubt about the importance of international trade for technology diffusion. Participation in international trade may increase the awareness of domestic agents about promising products, services or technologies and stimulate capability formation in enterprises (Fagerberg, Lundvall, and Srholec, 2016). Technology can be diffused to domestic enterprises through importing intermediate inputs, machineries, and equipment.

Firms importing intermediary goods benefit through technology embedded in the goods (Fu, Pietrobelli, and Soete, 2011). Indeed, the reasons for high productivity effect of using imported inputs are related to improved access to frontier technologies, quality of inputs, and firms' widened opportunities to specialize in activities of their best capability (Wagner, 2012). Similarly, Kugler and Verhoogen

(2008, 2009) indicated that plants importing inputs from foreign markets get access to more varieties and buy higher-quality inputs at a higher price. Kugler and Verhoogen (2008), particularly, found the working of quality-complementarity hypothesis (the hypothesis that input quality and plant productivity are complementary in producing quality output). They argued that the hypothesis carries an important implication regarding the role of trade in shaping industrial evolution in developing countries. Enterprises engaging in exports will also be exposed to transformation pressure. Firms engaged in export markets are forced to keep their products up to the market demand and the required standards due to the strong competition they face in the global market (Dimelis and Louri, 2004; Lee, 2013). Feedback from foreign consumers and competitors may stimulate upgrading of products and processes. However, effective upgrading through exports requires strong local capabilities and high emphasis upon learning.

According to classical growth theories, no process of technological change undergoes in developing countries apart from passively using technologies embodied in imported fixed capital (Bell and Albu, 1999). Technological progress is achieved by the fairly straightforward process of capital accumulation. In fact, imports of machinery and equipment are another important channel for foreign technology transfer (Fu, Pietrobelli, and Soete, 2011). The immediate effect of the technologies transferred embedded in these imported machinery and equipment is to increase the quality of products they produce. However, this does not mean that developing countries that import the machinery necessarily master the technology of designing and producing those advanced machines. There is a need for substantial technological learning and reverse engineering to grasp the technologies embedded in the imported machinery (Fu, Pietrobelli, and Soete, 2011).

As innovation is a cumulative process, there almost always exist national, home-spun adaptations and improvements during the diffusion of foreign inventions (Dalum *et al.*, 2010). Thus, borrowing product and process techniques from abroad is not an automatic process without frictions (Lall, 2003; Dalum *et al.*, 2010). Even importing new, readymade, stand-alone machines, for instance, when a firm wants to invest in machines for the first time, often involves substantial information and transaction costs. Besides, there are, often unforeseen or underestimated, costs of training and education and of organizational change as a consequence of the introduction of the new machinery and sometimes the machines themselves have to be adapted to fit into the new context (Dalum *et al.*, 2010).

3.4.2. FDI AS A MEDIUM OF TECHNOLOGY TRANSFER

Foreign direct investment (FDI) has long been regarded as a major vehicle for the transfer of advanced foreign technology to developing countries (Lall, 1992). Multinational enterprises (MNEs) that originate in technologically frontier countries are the power house of global R&D. They are considered to have the best quality human resources and operational skills. MNEs' investment in LDCs, therefore, would involve technological gain or improve productive efficiency of domestic firms in the host countries through linkages or spillover effect, if there is a good system or capability required to facilitate interactions with domestic firms (Veugelers and Mrak, 2009). While technology transfer through vertical linkages can be well understood, the mechanisms through which technologies spillover horizontally to domestic firms are less obvious.

Three major channels of spillovers have been identified by Blomström and Kokko (1998). The first happens when highly skilled workers from foreign firms move to domestic firms and apply their knowledge in the domestic firm. In line with this, Fosfuri *et al. (*2001) and Hale and Long (2006) have empirically proved the importance of movement of high-skilled workers and the corresponding knowledge externalities in facilitating horizontal spillover. The second is termed the "demonstration effect," which results from arm's-length-relationships between foreign and domestic firms whereby the latter learns superior production technologies from the former. The third channel is called the "competition effect" that results from increased entry of foreign firms into a sector. This would stimulate increased use of better technologies and more effective use of resources among domestic firms. Grossman and Helpman (1991) noted that, after the rapid advance in the technological capability of engineers in the newly industrializing economies, imitation becomes a more popular channel of technology transfer.

On the other hand, there could be negative competition effect, especially in developing countries, if foreign firms attract demand away from local firms (Blomström and Kokko, 1998; Aitken and Harrison, 1999; Görg *et al.,* 2009). In most cases, both negative and positive effects may coexist. For instance, Javorcik and Spatareanu (2005) found incidences of positive demonstration effect along with negative competition effect of FDI on domestic firms. The extent and the direction of the spillover effect that would pursue any of these channels may vary with country, sector, or other firm characteristics. In Chinese manufacturing, demonstration and contagion effects were found to be the important channels of technology transfer for collective and private-owned enterprises, while competition effect was more useful for SOEs (Li *et al.,* 2001). With respect to market orientation, they indicated that local market-oriented FDI benefits local firms mainly through competition. However, similar to the case of embedded technologies, host countries cannot fully tap the potential benefits of FDI without building local capability, using local content rules, incentives for deepening technologies, and export orientation (Lall, 2006).

3.4.3. INTEGRATION INTO GLOBAL VALUE CHAIN AND TECHNOLOGY TRANSFER

Gereffi and Fernandez-Stark (2011) noted that participation in Global Value Chains (GVC) can be seen as a particular form of openness to trade in which knowledge transfer takes place in a highly organized manner under the supervision of so-called “lead firms” governing the activities of the chain. It has a significant impact on the innovation and technology upgrading of those firms that successfully integrate in the GVC. In view of the evolving pattern of industrial organization in the world, integration in GVC involves an increasingly important opportunity for firms in LDCs. Not only does it represent a new market for their products, it does also play a growing and crucial role to access knowledge and enhance learning and innovation (Fu, Pietrobelli, and Soete, 2011). However, the learning impact of GVC depends on different characteristics of value chains, mainly, its governance (Pietrobelli and Rabellotti, 2011). Generally, LDC firms are supposed to learn and innovate based on their participation in the GVC because they have to satisfy the product quality, delivery time, process efficiency, environmental, labor, and social standards requirements of these chains.

However, empirical evidence (Kummritz, 2015; Fagerberg, Lundvall, and Srholec. 2016) is at odds with the intended outcome behind policy recommendations that insist low income countries to join global value chains controlled by foreign multinationals. The findings indicate that small, poor countries that increase their GVC participation grow significantly slower than other countries, even when other possible explanatory factors were controlled for. It was, however, indicated that, there is possibility for low income countries to benefit from joining GVC after building their technological capability, along with social capability and governance, that is, developing the national innovation system (Pietrobelli and Rabellotti, 2011; Fagerberg, Lundvall, and Srholec, 2016).

It is clear from the above discussions that being passive users of foreign technology does not help achieve sustained economic growth. It is only when local firms possess some level of initial capabilities and use the technologies to further build technological capabilities that external knowledge can successfully be acquired, hence contributing toward achieving productive structural change. In general, the ability to exploit internal knowledge and capabilities, access to existing external knowledge stocks, and the capability to exploit those stocks and adapt them for local development are crucial for developing economies (Nakandala, Turpin, and Djeflat, 2015). In the empirical analyses of this dissertation, we did not include integration in the GVC, despite its potential importance, mainly based on the evidence that only those countries with adequate technological capability can reap its benefits. It is assumed that trade and FDI are crucial in building such capabilities that will help realize the potential benefits from GVC later. In other words, building technological capability is viewed as a precondition for effective learning of any technology.

3.5. TECHNOLOGICAL CAPABILITY: A KEY FOR INDUSTRIALIZATION

For most economists, the word "technology" refers to the subset of knowledge that deals with how to produce and distribute goods and services. Particularly, technological progress is traditionally defined as movement in the production possibility curve or production of more quantities and types of goods using the existing resource. This definition appears to be narrow from the practical point of view. Mastery of physical processes is of doubtful value if one doesn't know how to embed these in a well-organized production and distribution system. Therefore, technology has to be understood as to include both the physical equipment ("hardware") and knowledge about how to organize/manage ("software") the physical process (Fagerberg *et al.*, 2010). Thus, it is better to consider a broader definition given by Dosi (1982):"a set of piece of knowledge both directly 'practical' (related to concrete problem and devices) and 'theoretical' (but practically applicable although not necessarily already applied), know how, methods, procedures, experiences of success and failures and also, of course, physical devices and equipment."

Lall (1992) differentiates between national technological capability and firm technological capability. However, national capabilities are not simply the sum of thousands of individual firm-level capabilities developed in isolation. Rather, it is better understood as what is determined by the interplay of capabilities, incentives, and institutions in developing countries. Even though it has implication for firm-level learning, here we only concentrate on firm-level capability. Bell and Albu (1999) defined technological capabilities as bundles of complementary skills and knowledge which, together with the organizational structures in which they are embedded, facilitate particular activities in the production system. It includes the ability to create new technology, imitate and adapt the technology to the local context (Lall, 2006). Specifically, the technological capability (TC) approach of industrialization argues that industrial success in developing countries depends on how firms master, adapt, and improve on existing technologies (Lall, 2006). While accepting greater openness, the TC approach argues that more reliance on markets should be accompanied by a more proactive intervention of less developed countries' governments toward creating conducive conditions in the process of capability building.

Bell and Albu (1999) summarized three mechanisms of acquiring technological capabilities. The first is through various internal technological activities including the observation of routine production activities; the acquisition of knowledge from undertaking repair, maintenance, or reconditioning of equipment; more systematic reverse engineering or experimentation; or more formally organized technology development or even applied research. Second, knowledge may be acquired from external sources, either relatively passively as a by-product from various kinds of interaction with the outside world or from a range of more deliberate and active search efforts though the deliberation and activity may sometimes be more evident on the part of the knowledge source than the recipient. Last, capabilities may be improved through various kinds of human capital formation at the firm level: either via formal and informal training activities or simply by hiring people who already embody the knowledge being sought. Capabilities acquired are stored in the form of knowledge embodied in people, codified in manuals and blueprints, or embedded in organizational arrangements and procedural routines. Many of the repositories of these resources are private to the firm, but they may also be shared or collective in the sense that they are embodied in creative linkages with and between other firms and institutions (Bell and Albu, 1999).

In other words, the operation of internally organized change-generating resources is not limited to the organization: it also involves interaction with external sources of technology including other firms and more specialized knowledge infrastructures. Such a combination of internal capabilities with external knowledge resources, and the links between them, have been termed as industrial “innovation systems,”“technology systems, "or “knowledge systems” (Bell and Albu, 1999), depending on which term applies in a given country context. The innovation system (IS) framework was developed from research in industrialized countries and hence better applicable, if not limited, to their context. It places learning at the center of building technological capability in view of the dynamics of global industrial organization and the corresponding growing importance of learning processes toward improved performance (Lundvall *et al.*, 2002). In this framework, firms interact with other firms and with non-firm organizations like universities, research centers, government agencies, financial institutions, etc. (Lundvall, 2010; Edquist, 1997).

The IS concept is relatively recent, but is rapidly gaining momentum in less-developed countries (LDCs) too. However, its applicability is not straightforward for several reasons (Pietrobelli and Rabellotti, 2011). First, innovation processes differ from those in developed countries, which are based on R&D activities. In LDCs, incremental innovation and absorption of knowledge and technologies new to the firm are more frequent and relevant than radical, new to the world innovation. Second, the main science and technology institutions such as universities, R&D laboratories, and research institutes may not exist in some LDCs or may be inadequate, and linkages among them and with local firms may be nonexistent or very weak. In LDCs, organizations that provide technology diffusion and extension services such as metrology, standards, testing and quality (MSTQ), and technical and organizational consultancies are more important. Third, inflows of knowledge and technology from external sources are essential components of the innovation and learning processes in LDCs. This reflects the fact that LDCs are seldom “innovators” in a narrow sense, but they crucially need to be able to acquire the foreign technologies relevant to their competitiveness, absorb them, adapt and improve them constantly as conditions change (Lall and Pietrobelli, 2005).

The foregoing facts imply that there is a need for different types of TC and IS in LDCs' context. Bell and Albu (1999) found that "technological capabilities" that were more relevant for LDCs were those that would help absorb, adapt, and persistently improve foreign knowledge and technologies in line with the underlying industrial dynamism. There was also a need for a compatible version of IS toward building the required type of TC. On this ground, Lall and Pietrobelli (2005) proposed an alternative concept of "National Technology System" (NTS) specific to the SSA context as depicted in Figure 3.1.

Similar to the IS concept, the NTS framework was shown to have focused on two aspects: technology policies (in the narrow sense) and technology institutions that would help develop the ability to absorb technology and knowledge produced elsewhere and to incrementally generate innovation. Technology policies are referred to include technology import by licensing and FDI, and incentives for local R&D and for training. Technology institutions constitute bodies such as quality, standards, metrology, technical extension, R&D and technology training. Many services rendered by these institutions are the essential "public goods" of technological effort. These are, therefore, among the areas where market fails, which calls for government intervention. Lall and Pietrobelli (2005) indicated that the public sector plays a central role in most SSA countries.

The more relevant institutions abbreviated as MSTQ (Pietrobelli and Rabellotti, 2011) provide the basic framework for firms to communicate on technology and keep the basic measurement standards to which the industry can refer. Extension services help overcome the informational, technical, equipment, and other bottlenecks that small and micro enterprises are likely to suffer. The role of public research institutes and universities does not seem to have short-term commercial benefits unlike that of developed countries. The basic research that they undertake is expected to provide the long-term base of knowledge for enterprise effort.

The framework shows that acquiring technologies from external sources involves the interaction of technology policy and technology institutions on the one hand, and the efforts firms make to acquire the technologies. The effort is aimed at building technological capability, which requires substantial investment in new skills, routines, and technical and organizational capabilities (Lall, 2006). This cannot be realized by leaving resource allocation, entirely, for the price system, as suggested by the neoclassical economists. The role of governments in developing countries is crucial to correct market failures in relation to the required investments in technology support institutions and providing policy support. Rodrik (2008) also appreciates the crucial role of governments along with the functioning of the market towards accelerating the pace of industrialization in LDCs.

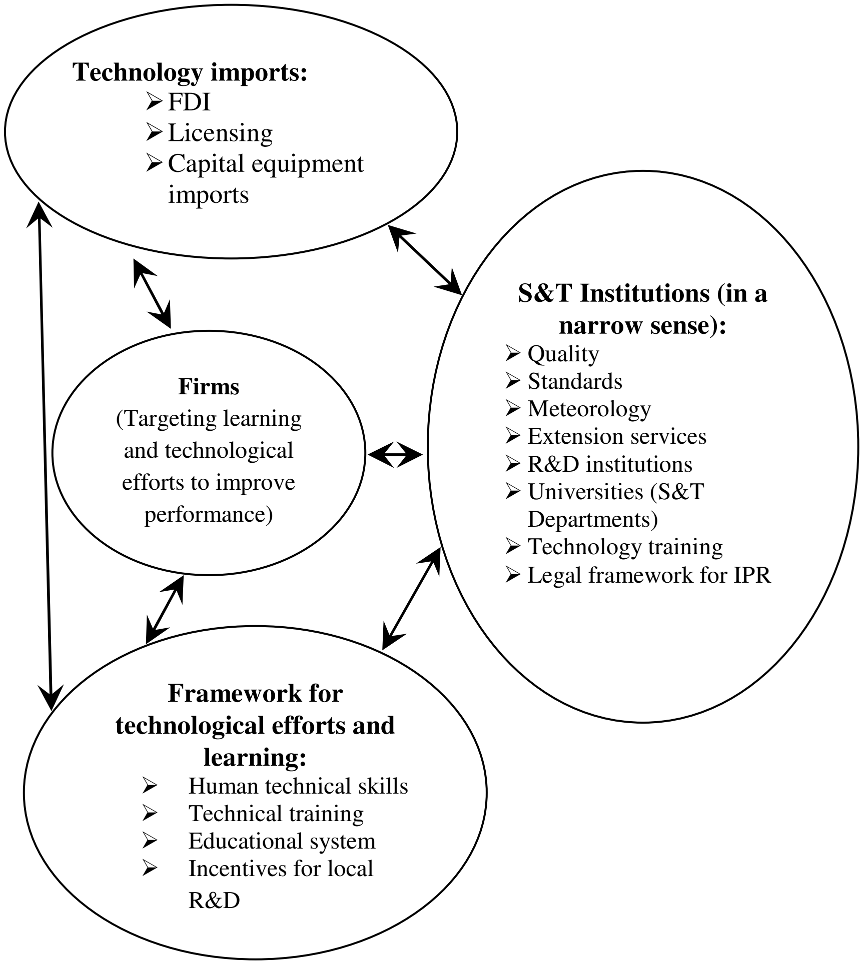

Figure 3.1 National technology system

Source: Lall and Pietrobelli (2005)

In general, it is worth noting that technological change is rooted in a specific set of change-generating resources or capabilities, which are embedded in the structure of technology using firms, rather than something that is merely chosen and bought by the firms from outside (Bell and Albu, 1999). Consequently, the learning processes that contribute to building and strengthening those capabilities are seen as playing an important role in the long-term dynamism and sustainability of industrial production (Bell and Figueiredo, 2012). All the foregoing sections were intended to build theoretical justifications for the importance of learning starting from boarder perspectives. Based on these, now we will turn to more focused theoretical underpinnings of firm-level learning accompanied by a simple model.

3.6. THEORETICAL BASIS AND FIRM-LEVEL LEARNING MODEL

3.6.1. THE THEORETICAL BASIS

In modern economies the most fundamental resource is knowledge and the most important process is learning (Lundvall and Johnson, 1994). It has been indicated that both accidental (passive) and purposeful (active) learning of any knowledge are vital for industrialization. Learning plays a significant role for firms intending to enter international markets. This seems to be well understood both by firms and policymakers in addition to scholars in the area. However, little is known about what can be done at the policy level to promote such learning. Tax breaks and diverse pecuniary incentives to accelerate learning and innovation tend to be always supported and sought by firms (Frischtak, 2006). The potential strategies to follow can better be envisaged after a comprehensive empirical investigation based on an appropriate analytical framework.

In neoclassical models, learning is understood either as gaining access to more information about the world (know-what) or it is treated as a black-box phenomenon as in growth models assuming “learning-by-doing” (Lundvall and Johnson, 1994). Insofar as they believe in perfect information and assume a one-way relationship between market structure and performance, classical theorists tend to ignore the broader implication of learning for performance. They believe in the optimizing firm rather than the learning and innovating firm. The optimizing firm assumes constant technological capabilities and market prices (both inputs and outputs), and seeks to maximize profits on the basis of these technological and market constraints (Lazonick, 2006).

However, neither technological capability nor prices are constant in the practical world. Both are subject to changes in the environment following the dynamic nature of the global economy. In such a dynamic world, the neoclassical type optimizing firm does not make much sense as it takes technology and market conditions as given. Instead, the innovating firm gives a better conceptualization to integrate the micro-foundation with the macro one given in previous sections. The innovating firm seeks to transform the technological and market conditions in an attempt to generate higher quality, lower cost products than had previously been available, and thus differentiate itself from competitors in its industry (Lazonick, 2006). If the competition crosses the national boundary of a country, firms need stronger efforts to learn. Fagerberg (2010) indicated that entrepreneurs strive to solve problems that arise in domestic markets, learn as possible solutions (innovations) are proposed, tested, and improved, and ultimately penetrate foreign markets on the basis of accumulated experience. This is an important learning process that contributes to the innovation process (Fagerberg, 2010).

Lall (1992) indicated that the micro-level analysis of technology in developing countries has drawn inspiration from the "evolutionary theories" developed by Nelson and Winter (1982). These theories begin with the view that firms cannot be taken to operate on a common production function. Firms do not equally share technological knowledge and it is not easily diffused across firms. The extent of mastering new technology is uncertain and necessarily varies by firm according to their skills, effort, and investment by the receiving firm. Therefore, different firms possess different knowledge about how to do things. In evolutionary theory, cognitive aspects such as beliefs, objectives, and expectations play a significant role in determining how firms do things. These aspects in turn are shaped by the environment in which firms act, and their previous learning and experience (Metcalfe, 1998). Furthermore, the environment and the conditions in which firms operate may differ considerably. The major differences correspond to the opportunity conditions related to science and technology, the knowledge base behind innovative activities, and the institutional background. Thus, the learning behavior and capabilities of firms are constrained and bounded by technology, knowledge base, and institutional context in which they act (Nelson and Winter, 1982).

Therefore, the analysis of firm-level learning and performance makes more sense if it is guided by the evolutionary economics perspective. In line with this, Coad (2009) finds evolutionary theory as a better alternative to analyze firm-level learning for several reasons. First, this perspective explicitly recognizes the heterogeneity of firms in terms of size, growth, productivity production methods, and technology among others. Second, evolutionary economics is based on a dynamic view of firms and industries. Third, evolutionary economics embraces the phenomenon of innovation in a way that other perspectives are not able to do. Fourth, the weak rationality assumption that forms the basis of the evolutionary framework suits more to the uncertainty that prevails in the modern economy than full rationality assumption of the neoclassical paradigm. Finally, the evolutionary perspective appears to be more or less in accordance with the empirical regularities that have emerged from research (Coad, 2009).

For a better understanding of the type of learning in SSA context, it is helpful to identify the two modes of learning and innovation explained by Jensen *et al.* (2007). One mode is based on the production and use of codified scientific and technical knowledge, the Science, Technology, and Innovation (STI) mode, and the other is an experience-based mode of learning through Doing, Using, and Interacting (DUI). The relative importance of these two is different between developed and developing countries. The DUI mode is more common in developing countries. Related to these modes, the ease with which a firm can learn depends on whether knowledge is "tacit" or "codified." Learning "tacit" knowledge is relatively difficult than that of "codified" type though this is not necessarily global. While the distinction between "tacit" and "codified" knowledge is important for firms in their knowledge management, both are equally important and complementary from the policy perspective (Johnson *et al.*, 2002).

In view of rapid technological progress, learning involves elements that go beyond "know-how" in the process and more complex knowledge management. Lundvall and Johnson (1994) introduced a very important distinction between "Know-What" (refers to knowledge about facts), "Know-Why,""Know-How" (refers to skills), and "Know-Who, "which has proved to be helpful in understanding knowledge creation and learning in innovation systems. Know-Why refers to knowledge about principles and laws of motion in nature, in the human mind and in society while Know-Who involves who knows what and who knows how to do. Even though these elements of knowledge are basically related to personal characteristics, they have an organizational dimension too. The importance of such distinctions of knowledge is stronger especially when contrasting the theoretical micro foundations of innovation systems (or technology systems) against those of mainstream economics (Lundvall and Johnson, 1994).

The organizational dimension of learning can be understood from the activities Hayes and Wheelwright (1984) identified as what constitutes organizational learning. These include individual learning, selection and training, improved methods, enhanced equipment and technology, division of labor and specialization, improved product design, substitution of capital for labor, incentives, and leadership. Organizational performance is determined by knowledge embedded in an organization's routines and standard operating procedures, in its products and processes, in its technologies and equipment, in its layout and structures, and in its culture and norms about how things are generally done, and knowledge of who is good at doing what (Levitt and March, 1988; Argote, 1993). Depending on these, firms differ in their productivity and growth performances. For example, Joskow and Rozanski (1979) associated gains in productivity with increasing experience manifested in terms of better routinization of tasks, more efficient production control, improved equipment design, and improved routing and material handling.

In the following section, we will try to depict the above characteristics in a specific theoretical model of firm-level learning within the framework of NTS (Lall and Pietrobelli, 2005).

3.6.2. MODELING FIRM-LEVEL LEARNING

Taking the evolutionary perspective as a guiding theory for firm-level learning, we build the general frame for the empirical analyses. Given the stage of development of the country (Ethiopia) in Porter's(1990) classification and the dominant type of industry in the country in light of Pavitt's classification, the major types of knowledge learned by firms relate to those from external sources in addition to the internal "learning-by-doing."In line with the concept of NTS, the DUI mode of learning and innovation is better applicable in the current context than the STI mode (Jensen *et al*., 2007). We conceptualize the DUI mode to include learning-by-doing, learning-by-using (including licensed technologies, technologies embodied in intermediate inputs, machines, and equipment), and learning-by-interaction within and outside the firm including other firms, customers, suppliers, and other supportive institutions. The knowledge to be learnt includes both “tacit” and “codified” types. On this ground, we borrowed and adapted Wignaraja's (2003) model, which demonstrates a general process of enterprise-level learning in a developing country context. The model is presented in Figure 3.2 with some modifications to fit the above theoretical basis and conceptual framework of this dissertation.

In light of the above theoretical basis, Wignaraja's (2003) model is the ideal choice to show a more detailed theoretical basis of firm-level learning according to the conceptual framework given in Chapter 1, Figure 1.2. The model constitutes the links among four important elements in the process of learning. These elements include imported technology, firm-level effort, inputs into enterprise learning, and phases of technological development. To make the model more complete and fit with our empirical analyses, we added two sub-elements under the four major elements and one additional bin as the ultimate outcome (performance). The first element is in regards to imported technology in embodied forms. Under this element we added intermediate inputs and machines in addition to what had been already listed. The second modification corresponds to the inputs into enterprise learning. Here we included competitive pressure and customer's demand in the export market. The last modification is that we added a major element (Performance) on the top right, which is assumed to have a positive feedback loop with technological capability (due to its path dependency) as indicated by the backward arrow. With respect to these minor modifications, it should be noted that the intention was just to incorporate all the major constructs expected to appear in the empirical chapters.

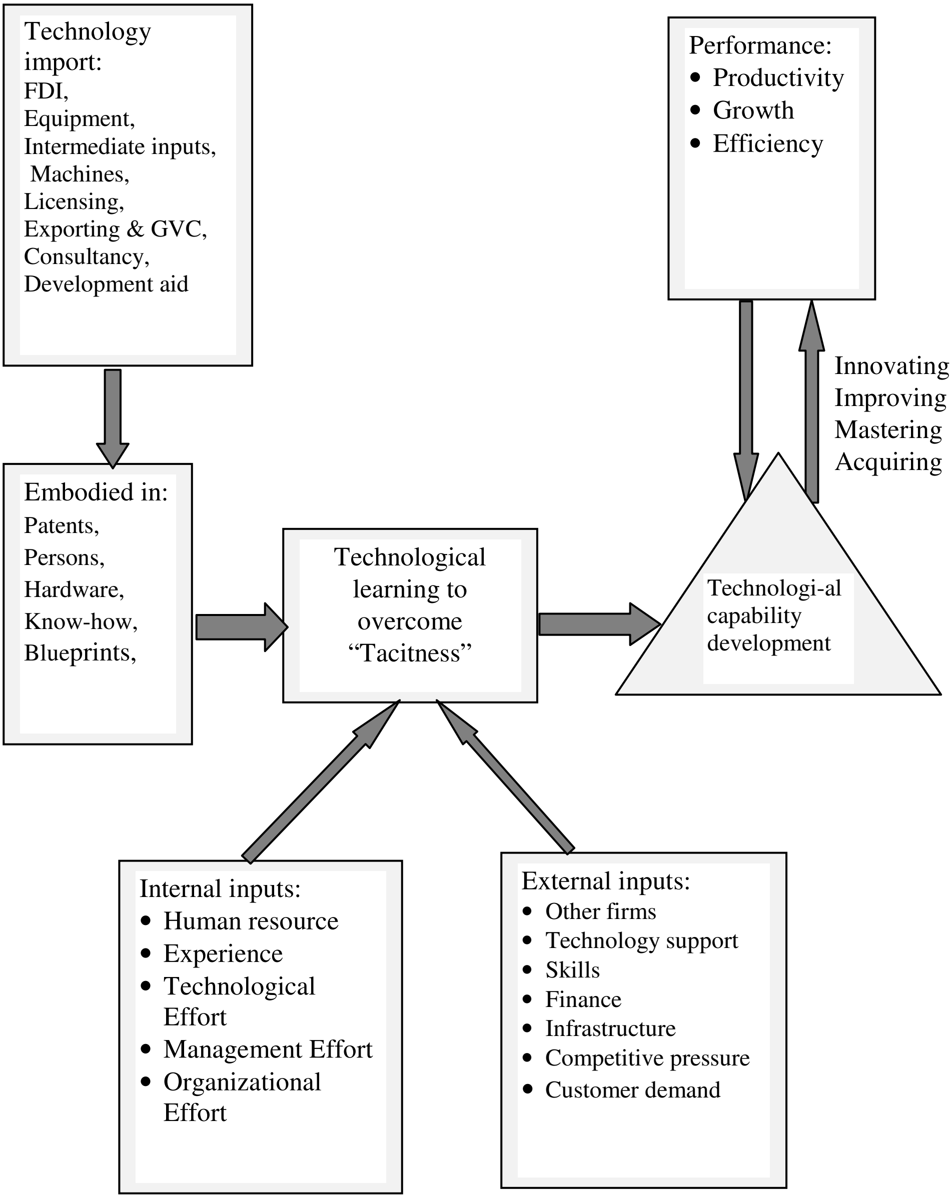

Figure 3.2 Enterprise-level learning process

Source: Adapted from Wignaraja (2003)

Similar to the original model, the process starts from the top left block where enterprises begin by importing technology in embodied forms. The possible channels of importing technology include FDI, technology licensing, exporting and integration to GVC, consultancy, development aid, technologies embodied in intermediate inputs, machines, and equipment. In view of the conceptual framework (Figure 1.2) in Chapter 1, these elements fit into the two bottom blocks of the model. Any imported technology is embedded either in patents, persons, hardware, know-how, or blueprints. For instance, technologies embedded in hardware represent, mainly, those embedded in imported intermediate inputs, machinery, and equipment. However, the full impact of these technologies on productivity cannot be realized without involving the software elements embedded in organization. If we take technology embedded in an imported machine, it is crucial that the labor force can learn to handle the machinery and to have technicians that can learn to maintain and repair the machinery (Fagerberg, Lundvall, and Srholec, 2016). Imported machinery can also be used to lay ground for domestic innovation if combined with reverse engineering, which, of course, requires building advanced engineering and design capabilities (Fu, Pietrobelli, and Soete, 2011). Similarly, integration into the GVC benefits only those with well-established industrial and technological capabilities (Fagerberg, Lundvall, and Srholec, 2016).

Technology transfer through FDI would be acquired embedded in both software and hardware elements. However, knowledge spillover from FDI to domestic firms, mainly, involves the software elements embedded in persons and/or organizational routines. This represents the absorptive capacity of a firm, which is crucial in determining the learning or productivity effect of FDI. This channel of acquiring external knowledge corresponds to the FDI block of the conceptual framework (Figure 1.2). When introduced by Cohen and Levinthal (1989), “absorptive capacity” was defined as the ability of firms to identify, assimilate, and exploit knowledge from the environment. Later (Cohen & Levinthal, 1990), the concept was extended as the firm's ability to distinguish the value of new information, incorporate it, and use it for commercial purposes. Cohen and Levinthal defined absorptive capacity also as a learning process that differs from learning-by-doing, which refers to a firm's ability to build more experience and efficiency in doing what it is already doing.

For empirical reasons, we also used the extended view of the concept of “absorptive capacity” by Zahra and George (2002). We are particularly interested in the dynamic and path dependency characteristics and the notion of potential and realized absorptive capacity. The reason is, first, our theoretical model is based on the evolutionary theory that believes in the cumulative and path dependency of learning and heterogeneities in firm characteristics. Second, we consider the potential absorptive capacity to be the firm’s capability to produce new product while the realized absorptive capacity is the improved performance of the firms in terms of productivity and efficiency. According to Zahra and George (2002), the immediate effect of absorptive capacity is to increase the flexibility of firms similar to the effect of learning as stated in Lundvall *et al.* (2002). Flexibility improves the speed of both learning (new methods) and unlearning (obsolete methods) in the process of production. Therefore, flexible firms are characterized by higher productivity, higher growth rates, better stability in employment, and higher probability to innovate new products (Lundvall *et al.*, 2002). Based on this logic, we used productivity- and efficiency-related measure of absorptive capacity in relation to FDI spillover (Chapter 6).

Building technological capability or absorptive capacity to acquire external technology involves investment (Lazonick, 2006), which would help improve the quality of internal inputs, and utilizing external inputs shown in the bottom two blocks of the figure. The internal inputs include human resources, experience, technological effort, management effort, and organizational effort. These are the major players behind the internal learning of a firm as depicted in the upper-most block of Figure 1.2. The external inputs in Wignaraja's model include technology support, skills, finance, and infrastructure, which are best accessed in the form of system or well-organized institutional support. In adapting the model to suit our purpose, we added additional entries including other firms, competitive pressure and customers, which are particularly relevant, but not limited, to firms engaged in the export market. Other firms can be thought of as an alternative source of knowledge acquired by a given firm through linkages or spillover effects. Customers may be much more important sources of technology than machinery suppliers. They would provide not only knowledge about product specifications but also a wide range of other elements such as operating procedures and know-how, or knowledge about materials properties (Bell and Albu, 1999). These additional entries are aimed at emphasizing the possibility of the "learning-by-exporting" hypothesis that will be tested in Chapter 5 of this dissertation.

The combined effects of importing technologies and configuring relevant knowledge repositories within and outside the firm create capabilities to learn and master the "tacit" elements of the imported technologies. This will in turn develop technological capabilities needed to apply new technologies for production purposes. However, it is difficult to empirical apply the above framework, mainly, due to data limit, apart from showing the detailed flow of the general firm-level learning process in LDCs. It is worth noting, for instance, the important channels of technology import that are not included in the empirical analyses. These are licensing, integration into GVC, development aid, and consultancy. We ignored licensing because its negligible contribution in technologies imported to LDCs (Fagerberg, Lundvall, and Srholec, 2016), while development aid and consultancy were excluded due to lack of data.

In its advanced stage, technological capability would help improve existing technologies or create new technologies. In other words, the process would involve sequential capability building that runs from acquiring to innovating. However, this is not necessarily observed in LDCs and hence can be skipped as depicted in the center right of Figure 3.2. In view of the NTS framework, such sequential ordering of capability seems to be ignored while the immediate impact of acquiring foreign technology can be reflected in terms of the performance of the acquiring firms. The effect on technological capability appears to be implicit as acquiring technology cannot be an end by itself without involving any capability.

Likewise, the empirical framework of this dissertation cannot explicitly show the whole process, but can show the relationship between firms' access to knowledge and their performances measured in terms of productivity or efficiency and growth or survival. Improvement in these performances is assumed to be the outcome of learning through improved capability and absorptive capacity. Alternatively, high performance can imply high technological capability or absorptive capacity pioneered by Cohen and Levinthall, (1989, 1990). This generally stems from the evolutionary view that firms are characterized by knowledge, capabilities, assets, organization, and routines, all of which are significantly heterogeneous and change constantly through firm efforts. Besides, knowledge and capabilities, as important changing features, exhibit path dependency implying a positive feedback loop between knowledge stock and capabilities, and firm performance. The forward and backward arrows in Figure 3.2 indicate this fact.

To summarize, the above theoretical frameworks indicate the importance of understanding firm-level learning as a complex process rather than a simple and passive process. It depends on the dynamics and interaction of internal and external factors. Firms in LDCs were shown to rely on foreign technologies but with differential capabilities to tap into the knowledge embedded in imported artifacts. Effective use of any knowledge for better learning and performance was indicated to involve coordination of internal inputs with inputs from external sources including customers, competitors, knowledge infrastructures, and other supportive institutions. This implies that a quantitative representation of such processes is difficult or often leads to black-boxing of essential elements. Given this limitation, the next section will elaborate the data and methodologies utilized for the empirical application of the basic framework.

3.7. ELABORATION ON DATA AND METHODOLOGIES

3.7.1. DATA

The data used for this dissertation are the most comprehensive firm-level data that exist for Ethiopia, which have been collected by the country's Central Statistical Agency (CSA) from large and medium scale manufacturing (LMM) establishments. The data have been gathered annually since 1976 as part of LMM industries' survey project aimed at providing statistical information on the country's manufacturing and electricity industries to alert policy interventionists on the changes taking place in the sector. The survey is confined to those establishments that engage 10 persons and above and use power-driven machinery and covers both public and private industries in all regions of the country. The survey is considered as the principal source of facts about the structure and functioning of manufacturing industries in Ethiopia.

The data constitute detailed information on establishments' year of commencing operation; major industrial groups; ownership, number of persons engaged, and employees; wages and salaries; sex; paid-up capital; gross value of production; industrial and non-industrial costs; value added; operating surplus; quantity of production; raw materials consumed; fixed assets; market of final products; investment; production capacity; and other business related aspects. However, there are no variables that directly measure innovation, R&D, and the quality of human capital of the establishments. Had they been included, these variables would have helped us measure firm-level learning more explicitly than the way it has been done in this dissertation. To provide some descriptive features of the data with respect to firms' ownership and export status, we presented data from which only repeated observations were excluded in Table 3.1.

As shown in the table, the number of private firms increased from 762 in 2000 to 1872 in 2011, while that of public-owned firms decreased from 121 to 62 between 2003 and 2011(or from 14% to 3%) indicating increased privatization. The number of foreign firms also increased from 44 in 2002 to 114 in 2011. On average, about 5% of the manufacturing firms belong to foreigners. Ethiopian manufacturing firms are characterized by their low participation in the international market. The data show that only 4–5% of firms have ever exported their products. Though there is an increase in the number of exporting firms in absolute terms, no improvement has taken place over the period in terms of the percentage.

As can be seen from the table, the number of establishments included in the LMM survey was lower in 2005 than that of the preceding years due to CSA's decision to reduce the sample in that specific year. In order to categorize firms into public-private and local-foreign ownership, we used the shares of current paid-up capital of the firms. There is, of course, a separate variable for ownership of firms in terms of private-public status in the original data. However, we did not use the variable as some firms appeared to be out of these categories. Instead, we defined a firm as "public" if the government's share in the firm's current total paid-up-capital exceeds 50%. Conversely, if the share of private ownership is in excess of 50%, the firm is categorized as "private."Similarly, a firm is considered "foreign" if foreigners have any amount of share in the current total paid-up-capital of the firm. As a result, observations in 2000 and 2001 were not placed into any of these categories.

Year	Private	Public	Foreign		Non-exporters	Exporters		**Total**
	Freq.	Freq.	Freq.	%	Freq.	Freq.	%	
2000	_	_	_	_	699	40	5.4	**739**
2001	_	_	_	_	684	38	5.3	**722**
2002	762	121	44	5.0	851	32	3.6	**883**
2003	807	132	42	4.5	898	41	4.4	**939**
2004	871	126	54	5.4	950	47	4.7	**997**
2005	643	120	50	6.6	712	51	6.7	**763**
2006	1,030	123	48	4.2	1,097	56	4.9	**1,153**
2007	1,221	118	51	3.8	1,281	58	4.3	**1,339**
2008	1,633	101	57	3.3	1,672	62	3.6	**1,734**
2009	1,856	92	76	3.9	1,870	78	4.0	**1,948**
2010	1,867	91	91	4.6	1,871	87	4.4	**1,958**
2011	1,872	62	114	5.9	1,852	82	4.2	**1,934**

Table 3.1 Total number of firms with their ownership and export status
Source: Author's computation

Following further cleaning of the data, the empirical analyses did not include all observations in the original dataset. First, we excluded observations with doubtful figures and missing values on the major variables such as sales, employment, and capital. Besides, the main analyses were based only on establishments with two and above observations as the main econometric technique requires. However, in order to compute sectoral variables such as market share, concentration index and foreign presence, all observations present in Table 3.1 were utilized.

3.7.2. ESTIMATION STRATEGIES

3.7.2.1 The general mathematical form of modeling learning

Based on the theoretical foundation, we will show the general forms of the empirical models that measure the observable outcome of the firm-level learning process in terms of the productivity and growth of firms, which are modeled as functions of various internal and external sources of learning. As indicated earlier, learning can take a form of learning-by-doing, knowledge transferred embedded in physical inputs and equipment, knowledge spillover, interactions with other firms and customers and so on. Here we distinguish between knowledge transfer and knowledge spillover as contributors of learning from external sources. The first one is learning obtained through training of personnel, sharing experience with other firms, and transfer of technology embodied in intermediate inputs, equipment, and machines. Knowledge spillover is mainly conceptualized as externalities produced in the environment. It could be acquired by interaction with other firms, workers' mobility, firm's effort induced by the competitive environment, and engagement in the international market. These kinds of externality could stem from frontier firms in a sector regardless of their ownership and origin.

A general model of productivity (*Prod*) can be specified as a function (*f*) of the stock of knowledge obtained through learning from internal (I) and external (X) sources and given by

$$Prod = f(I, X) \qquad 3.1$$

Firms' productivity varies with their respective learning and innovation capabilities. The extent to which a firm exploits internal capacity depends on its learning capability while access to and utilization of knowledge from external source requires strong absorptive capacity. Accordingly, a firm's productivity can be expected to be an increasing function of its capability or absorptive capacity. Therefore, the positive coefficients of a construct considered as a source of knowledge can be interpreted as a learning coefficient unlike other research that estimate such coefficients from a separate learning curve. The common learning curve is a declining function of cost with increases in output over time, which can be given as $C_{ij} = \alpha y_{ij}^{-\gamma} t_{ij}^{-\beta_i} exp^{u_{ij}}$ where C_{ij} is the unit manufacturing cost for the i^{th} batch of product j, y_{ij} is the quantity produced in batch ij, and experience, t_{ij}, is measured by the time elapsed since the product was first produced (Thompson, 2010).

In addition to productivity, we used firm growth in sales and employment as the outcome of learning and model growth as a function of different firm characteristic. The basic theoretical model of growth is based on Evans's (1987) specification given as:

$$grow = g(A_t, S_t, B_t) \qquad 3.2$$

Where *grow* is growth of a firm either in terms of sales or employment. A, S, B, and g denote age, size, the number of plants, and growth function, respectively. Including age and size is a wise practice in any firm-level growth equations. In our specification, we ignore B and include the stock of knowledge *f* to the right hand side (RHS) of Evan's growth equation and specify as

$$grow = g\big(A_t, S_t, f(I, X)\big) \qquad 3.3$$

The definitions of terms in the parenthesis are as given in the preceding equations. The coefficients of A and S are helpful to test theories like Gibrat's law of proportionate growth of firms and the passive learning model of Jovanovic (1982). If the coefficient of S is significant, it can be concluded that Gibrat's law does not hold

(Evans, 1987). The coefficients corresponding to variables in the third term of the RHS of Equation (3.3) are interpreted as learning coefficients.

The empirical versions of the above basic theoretical models are briefly presented below. The empirical modeling follows two-steps in which productivity and growth are estimated first. Estimating firm growth and labor productivity do not involve any empirical complexity unlike total factor productivity (TFP). Therefore, it is helpful to briefly explain the basic concepts about TFP and related issues around its estimation before explaining the actual empirical models.

3.7.2.2 Basic concepts on productivity and its estimation approaches

In two-factor traditional production function, productivity can be measured in terms of outputs per unit labor, outputs per unit capital, and the ratio of output to both labor and capital. The first two are partial measures while the latter is TFP, which is often associated with technology (Nadiri, 1970). According to Bartelsman and Doms (2000), studies on productivity growth can generally be categorized into two. The first is research that focuses on growth accounting and the estimation of factor demands using aggregate and sectoral data, while the second category constitutes research that examines the factors underlying changes in productivity at the firm level, namely evolutionary models of productivity growth. The earlier category belongs to the neoclassical versions, which are based on aggregation of variables into homogeneous groups and aggregation of many technically different microeconomic production functions derived from “a representative firm.” This requires very stringent assumptions about the inputs, outputs, and techniques of production. Nadiri (1970) noted that aggregation is a serious problem that leads to estimating biased coefficients for inputs affecting the magnitude, the stability, and the dynamic changes of total factor productivity. In the face of emerging evidence (for example, Baily *et al.,*1992, and Bernard *et al.,*2003) on the widespread heterogeneity among firms within an industry, the restrictive assumptions underlying the use of a measure of aggregate productivity based on the representative firm do not seem to help.

Empirical studies from the evolutionary models of productivity growth recognize widespread and persistent heterogeneity across firms regarding their productivity, and seek to explore the factors behind this heterogeneity within the framework of firm behavior (Bartelsman and Doms, 2000). From the evolutionary perspective, the non-negligible part of the differences in production efficiencies (no matter how measured, e.g., in terms of labor productivities or TFPs) must be due to different distributions of capital equipment of different vintages, while broader differences are expected to be the outcome of idiosyncratic capabilities (or lack of them), mistaken-ridden learning, and path-dependent adaptation (Dosi and Nelson, 2010). From the neoclassical perspective, available technology and market conditions (primarily factor prices) are the only factors considered to determine firm productivity at any time (Nelson, 1981).

The fundamental objective of productivity measurement is to identify output differences that cannot be explained by input differences (Van Biesebroeck, 2007). A firm is considered more productive than another if it can produce the same output with fewer inputs or if it produces more output from the same inputs. Researchers also estimate productivity to study the impact of some policy measures or the role of trade liberalization (Van Beveren, 2010). The estimated productivity can be partial or total factor productivity (TFP) measured as the ratio of output to inputs used. Estimating any productivity measure involves observing inputs and outputs accurately and controlling for input substitution that a given production technology allows (Van Biesebroeck, 2007). Partial factor productivity is defined as the ratio of the quantity of output (or value-added) to the quantity of the factor of production for which productivity is to be estimated (such as labor and capital). However, if factor proportions vary partially, productivity measures provide a distorted picture regarding the role of each factor in changing the level of production. In this case, TFP provides the best picture and is considered the broadest measure of productivity and efficiency in utilizing productive resources. TFP is defined as the rate of transformation of total input into total output (Diewert and Nakamura, 2007). However, there has been no limitation-free method of estimating TFP. The methods used in empirical literatures can be broadly classified into non-parametric, parametric, and semi-parametric depending on statistical techniques and the corresponding assumptions to be met.

The non-parametric techniques of computing TFP include the index number and the data envelopment analysis (DEA) methods, which are known to be very flexible in the specification of technology, but do not allow for unobservable factors. Index umber methods are also called growth accounting approaches that are theoretically motivated to aggregate both inputs and outputs. There are different index number formulas as reviewed in Diewert and Nakamura (2007). For all the formulas to work, a number of restrictive assumptions must be satisfied. The major ones include perfect competition in output and input markets, optimizing behavior by firms, and correct estimation of inputs and outputs. However, the index number approach has an advantage due to its straightforward computations, the ability to accommodate multiple outputs and inputs, and its flexibility and capacity to accommodate heterogeneous production technologies. The deterministic nature of the model and the necessary assumptions on firm behavior and market structure constitute the main disadvantages (Van Biesebroeck, 2007).

TFP can be measured using DEA following Färe *et al.* (1994), given that suitable panel data are available. In DEA (also called non-parametric frontier estimation), productivity is obtained after estimating efficiency of each observation using linear programming. Efficiency is defined as the ratio of a linear combination of outputs over a linear combination of inputs. No particular assumption on production function or technology is required. It only involves choosing weights on inputs and output to maximize efficiency (productivity) for a given observation where a linear programming problem is solved separately for each observation. Van Biesebroeck (2007) provided the pros and cons of both parametric and non-parametric TFP measures. Unlike non-parametric methods, parametric approaches assume input substitution and returns to scale are the same for all firms. Considering the advantage of using semi-parametric technique over parametric and non-parametric approaches, we applied the former in computing TFP to be used throughout this dissertation. The following subsection presents the specific estimation strategy applied.

First step: Productivity Estimation

In order to estimate TFP, it is necessary to follow a given form of production function. Accordingly, we begin by specifying a production function assuming a Cobb- Douglas form with Hicks-Neutral technology and three inputs namely capital (K_{it}),, labor (L_{it}), and intermediate materials (M_{it})given by

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m} \qquad 3.4$$

where Y_{it} represents output measure of firm i in period t, A_{it} is the TFP or the efficiency level of firm i in period t. Computation of variables in Equation 3.4 is given in Appendix A1. Taking natural logarithms of (3.4) gives a linear function of the form

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it} \qquad 3.5$$

where $ln(A_{it}) = \beta_0 + \varepsilon_{it}$ in which β_0 measures the mean productivity level across firms and overtime while $\varepsilon_{it}$is the time- and producer-specific deviation from that mean. Small letters in (3.5) represent the natural logarithms of the inputs. Following Van Beveren (2010), the last term of (3.5) can be further decomposed into observable and unobservable components and gives

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varphi_{it} + \eta_{it} \qquad 3.6$$

where $\omega_{it} = \beta_0 + \varphi_{it}$represents firm-level productivity (φ_{it} is the productivity difference)and $\eta_{it}$is an i.i.d. component, representing random deviations from the mean due to measurement error, unexpected delays, or other external circumstances. In all parametric and semi-parametric approaches, (3.6) is estimated to solve for ω_{it}, which is a firm-level productivity measure. In order to get a better estimate of this measure, input parameters need to be estimated correctly.

Least Squares (OLS) is one of the parametric methods traditionally used to estimate productivity of a firm as a residual. However, this method requires that the inputs in the production function are exogenous or determined independently of the firm-level productivity (ω_{it}), which hardly happens in practice. Literatures refer to the work of Marschak and Andrews (1944) to have first identified that inputs in the production function are determined by firm characteristics rather than independently chosen by the firm. As a result, consistent estimation of the input parameters in (3.4) faces an endogeneity problem (Olley and Pakes, 1996; Van Biesebroeck, 2007). Since firms choose input levels based on their firm characteristics, including its level of productivity, an OLS regression of output on inputs will give inconsistent estimates of the production function coefficients. Among the alternative estimation methods developed to solve problems caused by the endogeneity of input choice in production function, the semi-parametric method of Olley and Pakes (OP) (1996) has wide popularity in literatures. In addition to correcting for the endogeneity problem, the estimation algorithm developed by Olley and Pakes (1996) was the first to tackle selection bias or "endogeneity of attrition" by incorporating an exit rule into the function. Selection bias is the problem that arises when TFP is estimated on a balanced panel (excluding entry and exit) while there is correlation between exit and productivity. OP developed a dynamic model of firm behavior that allows for idiosyncratic productivity shocks, as well as for entry and exit. Simultaneity problem is solved by using the firm's investment decision to proxy for unobserved productivity shocks.

OP relies on two important assumptions. First, productivity, a state variable in the firm's dynamic problem, is assumed to follow a Markov process unaffected by the firm's control variables. Second, investment, one of the control variables of the firm, becomes part of the capital stock with a one period lag. Based on the production function given by equation (3.5), OP's estimation is as follows. Capital is a state variable, only affected by current and past levels of ω_{it}. Investment can be derived from the capital rule as:

$$I_{it} = K_{it+1} - (1 - \delta)K_{it}$$

OP used lagged investment to invert productivity in their estimation algorithm, though it makes more sense to use current capital in empirical application as it leads to underestimation of the capital coefficient (Van Beveren, 2010). Investment decisions at the firm level can be shown to depend on capital and productivity or $i_{it}= i_t(k_{it}, \omega_{it})$, where lowercases refer to logarithmic transformation of variables. OP maintained the assumption that investment is strictly increasing in productivity, conditional on capital, the investment decision can be inverted to allow expressing unobserved productivity as a function of observables as $\omega_{it}= h_t(k_{it}, i_{it})$ where $h_t(.) = i^{-1}t$ (.). Then, equation (3.5) can be rewritten as

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + h_t(k_{it}, i_{it}) + \eta_{it} \qquad 3.7$$

Despite its desirable characteristics, estimation of TFP based on equation (3.7) is weakened by the imposed monotonicity condition of OP that requires investment to strictly increase in productivity. This leads to substantial efficiency loss as it implies that only observations with positive investment can be used when estimating equations. Besides, the fact that large number of firms can report missing values of investment deepens the problems in the monotonicity condition (Levinsohn and Petrin, 2003; Van Beveren, 2010).

As a result, Levinsohn and Petrin (2003) developed an algorithm that uses intermediate inputs to proxy for unobserved productivity shock rather than investment. Because firms typically report a positive use of materials and energy each year, it is possible to retain most observations, which also implies that the monotonicity condition is more likely to hold. Invoking the assumption that demand for the intermediate input m_t depends on the firm's state variables k_{it} and ω_t: $m_{it} = m_t(k_{it}, \omega_{it})$.With a mild assumption about the production function, they show that the demand function is monotonically increasing in ω_t, which allows for the inversion of the function as $\omega_{it} = s_t(k_{it}, m_{it})$ where$s_t(.) = m_t^{-1}(.)$. Using this expression, equation (3.4) can be rewritten as

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + s_t(k_{it}, m_{it}) + \eta_{it} \qquad 3.8$$

The last identification restriction by Levinsohn and Petrin (LP) (2003) is to allow productivity to follow a first-order Markov process analogous to the OP method $\omega_{it} = E[\omega_{it}|\omega_{it-1}] + \xi_{it}$.

Both OP and LP methods involve two-step estimation strategies to compute TFP. Their difference is that the first used investment to solve endogeneity while the second used raw material inputs. Second, the OP method corrects for selection bias while the LP method does not. Levinsohn and Petrin (2003) ignored selection effect, arguing that the efficiency loss due to the effect is insignificant, provided unbalanced panel data is used. In comparing all the alternative measures, Van Beveren (2010) indicated that when firms face idiosyncratic productivity shocks that are not entirely transitory, the semi-parametric proxy estimator can better exploit the firms' knowledge about these shocks. Based on this, the TFP measure used throughout this dissertation was estimated using LP method.

In addition to the methods of estimation, the type of output measures in equation (3.5) matters while computing TFP. Computing TFP and TFP growth requires also choosing between value-added and gross output as alternative measures of output variable. Value added is superior to gross output in inter-industry level studies because the latter includes cost of intermediate inputs, which may vary greatly across industries (Diewert, 2000). More interestingly, Griliches and Ringsted (1971) noted that value added not only allows comparison between the firms that are using heterogeneous raw materials, but also takes differences and changes in the quality of inputs into account. Therefore, we used value added, deflated by industry level price, as a measure of output.

Second step: Empirical Modeling

After estimating TFP, we fitted productivity and growth equations since heterogeneity in the performance of firms is of primary interest, as it reflects differences in learning capability, which is in line with the evolutionary theory. The productivity measures estimated in the first step using LP method were used in all the three empirical chapters (Chapters 4 to 6). In Chapter 4, TFP was included in the RHS of the growth equation to explore the growth-productivity nexus. The main estimating equation in Chapter 4 is given by

$$g_{it} = \beta_0 + \beta_1 size_{it-1} + \beta_2 lnTFP_{it} + \beta_3 \ln{(K/L)_{it}} + \beta_4 lnage_{it} + \beta_5 Foreign + \beta_6 private + \beta_7 CI + \beta_8 export + \beta_j \delta_i + U_{it} \quad 3.9$$

where g_{it} is the growth of a firm (either sales or employment growth);$size_{it-1}$ is one year lagged value of the natural logarithm of the number permanent employees of a firm, *lnTFP* is the natural logarithm of TFP; K/L is capital labor ratio, *lnage* is the natural logarithm of age of the firm since its establishment;$export$ is dummy for export; *Foreign* is dummy for foreign ownership; δ_i are dummies for sector and year; and$U$ is a random error term. Variables *lnage, export, Foreign, private,* and the dummies for year and sector were included to control for the heterogeneity of firms. We added year dummies to capture macro productivity shocks and two-digit industry affiliation to account for the sectoral effect of growth.

In addition to the above growth regression, panel probit was applied to estimate firms' exit probability including the potential determinants of exit or survival. The equation used to estimate exit probability (as a function of one year lagged value of variables in the RHS) is given by

$$Exit_{it} = \alpha_0 + \alpha_1 size_{it-1} + \alpha_2 lnTFP_{it-1} + \alpha_3 \ln{(K/L)_{it-1}} + \alpha_4 lnage_{it-1} + \alpha_5 CI_j + \alpha_6 privat_{it} + \alpha_7 export_{it-1} + e_{it} \quad 3.10$$

where *Exit* is the binary variable assuming value "1" if a firm exit in year "t" and "0" otherwise; α are parameters to be estimated, e_{it} is the error term supposed to constitute two components. Market concentration (CI) and TFP were the main variables of interest. To examine the impact of size and efficiency on exit of firms in a more concentrated sector, interactions of CI with size and efficiency (i.e., CIxSZED and CIxHEFFG) were added in equation (3.10). CIxSZED is the interaction between CI and dummy for large firm (firm with above mean size).

CIxHEFFG is the interaction between CI and dummy for high efficiency gap of firms (HEFFG), which was computed after estimating efficiency score, following the Wang and Ho (2010) approach (see Appendix A2 for details). Equation (3.10) was used to examine the impact of learning and market selection on firm exit.

Chapter 5 examined the impact of embodied technology transfer and exporting on firm productivity. The second step estimating equation was specified as

$$\begin{aligned} P_{it} = \gamma_0 + \ \gamma_1 P_{it-1} + \gamma_2 export_{it} + \gamma_3 NKINV_{it} + \gamma_4 MRMint_{it} + \gamma_5 lnage_{it} \\ + \gamma_6 size_{it} + \gamma_7 private_{it} + \gamma_8 CI_{jt} + \gamma_9 Foreign_{it} \\ + \gamma_{10} D_{ij} + \mu_i + E_{it} \qquad 3.11 \end{aligned}$$

where *P* represents any of the productivity measures in a natural logarithm (ln*LabP, lnTFP, or* $catch_{TFP}$) used as a dependent variable; *export* is dummy for exporting; *NKINV* is the ratio of new capital to total fixed capital; *MRMint* is the proportion of imported inputs; *lnage* is the natural logarithm of firm age; *size* is the natural logarithm of firm size; *private* is dummy for private ownership; γ are coefficients; *D* is vector of year and sector dummies; μ_i is firm-specific effect; and E_{it} is a random disturbance term assumed to be distributed identically and independently across firms. Other variables are as defined earlier. The subscripts *i, j,* and *t* stand for firm, sector, and year, respectively.

When *TFP* and *catchTFP* are used as dependent variables, improvement in these variables due to the impact of the RHS variables can be interpreted as improvement in technology, though *TFP* would account for a hodge-podge of factors difficult to sort out (Nelson, 1981).The third, fourth, and fifth terms in the RHS variables constitute the main variables of interest in Chapter 5. The positive significant coefficients of these terms would show evidence of "learning-by-exporting,""learning-by-investment in new capital," and "learning-by-importing," respectively. Matching techniques were also applied to test the potential impact of firms' self-selection into exporting, investment, and importing.

Chapter 6 analyzed the impact of foreign presence on the domestic firms in terms of their TFP and sales growth. The second step estimating equation included FDI variable and its interaction with a proxy of absorptive capacity in the RHS variables as the two main variables of interest. The TFP version of the equation was specified as

$$\begin{aligned} TFP_{it} = \beta_0 + \beta_1 export_{it} + \beta_3 FDI_{it} + \beta_3 FDIxREL_{TFP\,it} + \beta_5 lage_{it} + \beta_6 size \\ + \beta_7 private + \beta_8 CI + \beta_j \delta_i + \zeta_{it} \qquad 3.12 \end{aligned}$$

where *export* is a dummy for export; FDI is a measure of foreign presence; $FDIxREL_{TFP}$ is the interaction between FDI and relative productivity that would measure absorptive capacity. The positive coefficient of this term indicates that spillover effect is higher for firms with higher absorptive capacity (Cohen and Levinthal, 1989). *lage* is the natural logarithm of age of the firm since its establishment; δ_i are dummies for sector and year; and ζ is the random error term. Variables *lage, export, size, private, CI,* and the dummies for year and sector are included to control for the heterogeneity of firms. We added year dummies to capture macro productivity shocks, two-digit industry affiliation to account for the sectoral. Without year and industry positive coefficients on the FDI variables could simply reflect the tendency of foreign firms to invest in high productivity sectors or favorable macroeconomic environments (Girma and Wakelin, 2007).

However, there are problems in estimating equations (3.9), (3.11), and (3.12) using OLS and fixed or random effect models due to the correlation of the lagged value of the dependent variables with the fixed effect in the error term giving rise to what is called dynamic panel bias (Roodman, 2009). The RHS variables would not be exogenous as they are required to obtain consistent estimators. Thus, there will be endogeneity and reverse causality is inevitable. Time-invariant firm characteristics (fixed effects), such as sector and managerial skills, may be correlated with the explanatory variables.

Roodman (2009) indicated that some of the approaches like the least square dummy variable (LSDV) and instrumental variable approaches can partially solve the problem. Specifically, he pointed out that LSDV works only for balanced panel data and does not address the potential endogeneity of other regressors. Arellano and Bond (1991) developed a generalized method of moment (GMM) technique that eliminates bias through transformation of the variables. Furthermore, Blundell and Bond (1998, 2000) improved the estimation method due to the fact that the validity of instruments from first differencing transformation may suffer in cases where input and output variables are persistent. Specifically, they found that the performance of the first-differenced GMM estimator is poor if values of the autoregressive component are high. Blundell and Bond (1998) developed two estimators that can improve the precision of the standard GMM estimators. Of the two estimators, we applied the approach that imposes an additional restriction on the initial conditions process, under which all the moment conditions available can be exploited by a linear GMM estimator in a system of first-differenced and levels equations. In their Monte Carlo simulation, the extended system GMM that uses more moment conditions from lagged first difference of the dependent and independent variables was found to increase efficiency of estimators. Moreover, between two-step system GMM and one-step system GMM, we applied the latter. The reason is that the one-step system GMM is the more reliable estimator in terms of power and error type-I than the two-step estimator (Soto, 2000).

According to Roodman (2009), there are two available transformations in implementing the system GMM: differenced transformation and forward orthogonal deviations. He indicated that the former has limitations, especially, in case of unbalanced panel data since it leads to loss of some data following the transformation. Thus, we applied the second option for unbalanced data, which is computable for every observation except the last for each firm thereby minimizing loss of data. The Arellano and Bond tests of autocorrelation and the Sargan/Hansen test for joint validity of the instruments were applied as they are standard tests after GMM (Roodman, 2009).

Since this thesis used long panel data, it was possible to handle some of the estimation problems. Bartelsman and Doms (2000) indicated that studies that use firm-level longitudinal data can take explicit account of heterogeneity among firms in the same sector and help fill the missing link between studies from the productivity growth accounting literature and the evolutionary model. They also allow a detailed examination of how individual characteristics drive cross-sectional productivity differentials, and how the latter affects average productivity growth. More elaborate estimation strategies are presented in the ensuing empirical chapters. However, due to the fact that we applied system GMM in all the chapters, the basic methodologies are necessarily similar provided that each chapter is considered as an independent paper.

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APPENDIXES

A1: *Computation of Variables for production function*

Output (Y): is the gross value of production, which is computed as the sum of sales revenue and change in stock during the year. We used the usual way of deflation using sector-specific product deflator following the methodology adopted by the Ethiopian Ministry of Finance and Economic Development taking 2000 as a base year.

Labor (L): labor is an input measured in terms of the number of permanent employees.

Capital (K): was constructed using the formula,

$$K_{it} = K_{it-1} + \frac{Inv_{it}}{capD_{it}} - D_{it} - disposed_{it}$$

where "inv" is investment in capital during a year, "D" is depreciation during the year and disposed is capitals disposed of during the year and "*capD"* is an implicit fixed capital deflator computed from the World Bank's database on capital formation. It was computed as the ratio of gross capital formation at current local currency to gross capital formation at constant local currency (using year 2000 prices as a base). The *i*, *0,* and *t* subscripts stand for firms' identity, initial period, and time period, respectively.

Intermediate inputs (M): this variable was computed as the sum of expenditures on all raw materials, energy inputs including electricity, water, and other industrial and non-industrial expenditures. To find its real value, we deflated using implicit GDP deflator from the World Bank's Development Indicator database taking 2000 as a base year.

A2: *Computing efficiency score using Wang and Ho's (2010) approach*

Wang and Ho (2010) criticize earlier models of stochastic frontier estimation due to their limitations in terms of complication in the empirical estimation of the models and problem of incidental parameters. As a solution to the problems, they proposed a different panel stochastic frontier model that has a fixed-effect specification, which allows functionally tractable likely-hood estimation and model transformations. After transforming the model, the fixed effects are removed before estimation based on which it is possible to obtain consistent maximum likelihood estimators for the panel stochastic frontier model. Based on this ground, we applied Wang and Ho's (2010) model specified as,

$$y_{it} = \alpha_i + x_{it}\beta + \varepsilon_{it} \qquad (i)$$

$$\varepsilon_{it} = u_{it} - v_{it} \qquad (ii)$$

$$v_{it} \sim N(0, \sigma_v^2) \qquad (iii)$$

$$u_{it} = h_{it} \cdot u_i^* \qquad (iv)$$

$$h_{it} = f(z_t\delta) \qquad (v)$$

$$u_i^* \sim N^+(\mu, \sigma_u^2). \qquad \mathrm{i} = 1, \dots, \mathrm{N}, \mathrm{t} = 1, \dots \dots, \mathrm{T}. \qquad (vi)$$

where y_{it} is the log of output, x_{it} is a vector of log of inputs and other factors;α_i is firm i's fixed unobservable effect; v_{it} is a zero-mean random error, u_{it} is the technical inefficiency, and h_{it} is a positive function of a 1×L vector of non-stochastic inefficiency determinants (z_{it}). Neither x_{it} nor z_{it} contains constants (intercepts) because they are not identified. The notation "+" indicates that the underlying distribution is truncated from below at zero so that realized values of the random variableu_i^* are positive. The random variable u_i^* is independent of all T observations on v_{it}, and both $u_i^*$and v_{it} are independent of all T observations on $\{x_{it} ; z_{it}\}$.The main justification for using this model is because of its capability to separate firms' inefficiency from their heterogeneity.

The resulting efficiency index we computed can be specified as$EFF = E(e^{-u/\varepsilon})$.Then the dummy for high efficiency gap (*HEFFG*) (difference between the efficiency score of a given firm and the maximum efficiency score in a two-digit sector) was generated to be used in the equations.

CHAPTER 4. FIRM HETEROGENEITY, GROWTH PERFORMANCE, AND EXIT IN THE ETHIOPIAN MANUFACTURING SECTOR: THE ROLE OF PRODUCTIVITY AND CAPITAL INTENSITY

Abdi Yuya Ahmad

ABSTRACT

This paper examined firm growth and exit in the Ethiopian manufacturing sector using firm-level data in 2000–2011 from medium and large manufacturing firms with 10 and above permanent employees. We analyzed firm growth and exit controlling for firm heterogeneity in terms of size, age, sector, ownership, and other performance indicators. We argued that productivity and capital intensity are important for enhancing the growth of firms and reducing the exit probability. We also hypothesized that firms in more concentrated sectors are more likely to exit, while this effect is expected to be stronger among small and inefficient firms. To verify our argument, we adopted a two-step estimation strategy where productivity and efficiency were first estimated using a semi parametric approach of Levisohn and Petrin and stochastic production frontier, respectively. Then, we estimated growth and exit regression using system GMM and panel probit models in their respective orders. Results showed that firms with high productivity and high capital intensity recorded better growth rates. Exporting firms and firms owned by foreigners are also better in their growth. Productivity and capital intensity also helps to reduce the risk of exit. Young and small firms appeared to have higher exit probability. Firms in more concentrated sectors are more likely to be competed out and the effect was found to be stronger among less efficient firms.

Keywords: Manufacturing firms, firm growth, productivity, firm exit, capital intensity

4.1. INTRODUCTION

In less developed countries where industries are in their infancy, firm growth is important in determining the future of the countries' industrial structure and competition. Analyzing firm growth has important policy implication for the development of the industrial sector in a globalizing world (Coad, 2007a). Goedhuys and Sleuwaegen (2009) described that fast-growing firms have the potential to generate employment, build technological capabilities, and create physical and human capital. For this reason, voluminous empirical studies have been conducted dealing with firm growth in diverse disciplines (Coad, 2009). Studies that have been undertaken on the growth of firms found wide dispersion of growth rates across firms. After the seminal work of Jovanovic (1982), firm growth has enormously been understood and examined as a learning process to explain why small and young firms grow faster in a competitive environment. This paper examines the determinants of firm growth and exit in Ethiopian manufacturing.

The varying differences in firms' growth performance have been investigated in both developing and developed regions of the world. Some firms perform better by improving their productivity and growing better than others. The steady growth in productivity of firms with eventual addition to their size can be interpreted as the "learning-by-doing" effect (Coad, 2007b), learning-by-using, and learning-by-interacting. On the other hand, if firms do not show any growth over time with no improvement in their productivity, it would mean that there was no efficiency gain or that resources that have been freed from the gain are merely absorbed as organizational slack. The indicator of success for firms, therefore, is translating what has been learnt into better growth and boost in profit (Coad, 2007b). Sleuwaegen and Goedhuys (2002) indicated that the specific characteristics of entrepreneurs and a wide range of growth-limiting factors from both the demand and supply sides are also important in addition to the learning process.

One unique characteristic of manufacturing firms in Africa is small firms' failure to grow into large firms creating what is called the "missing middle problem" (Sleuwaegen and Goedhuys, 2002). Some of the reasons for this problem are financial constraints, transport costs, limited infrastructure, and lack of suitable management and technical skills. In terms of job creation, the vast majority of Africans are engaged in small and micro enterprises. But due to the empirical fact that small firms are the ones that are more likely to exit, the jobs created tend to be volatile. Therefore, creating fast-growing firms seem necessary for more stable jobs. Even in developed countries the superiority of USA over Europe in providing new jobs relates to USA's ability to create new, fast-growing companies (Navaretti *et al.*, 2014). Therefore, it is important to identify what makes firms' birth, survival, and growth so that they would ultimately create stable jobs in Ethiopia assuming similar trajectories of firm growth dynamics in Africa.

Several studies have been conducted on the growth and survival of firms in the Ethiopian manufacturing sector. These include Shiferaw (2007, 2008), Gebreeyesus (2008), and Bigsten and Gebreeyesus (2007). Shiferaw (2007, 2008) studied firm survival and market selection of Ethiopian manufacturing firms using data in 1996–2002. Gebreeyesus (2008) examined the patterns of entry and exit and how these patterns affect industry productivity growth using data from 1996 to 2003. Bigsten and Gebreeyesus (2007) used 1996 to 2003 annual manufacturing census to examine determinants of growth of firms. However, due to the dynamic nature of the investment climate and markets, the previous findings may not remain similar and there needs to be a fresh analysis about the status of firm-level learning from all possible developments.

In addition to filling the gap in recent developments, the current study examined both growth and survival behaviors of firms. Bigsten and Gebreeyesus (2007) used employment growth as a dependent variable in their analysis while we used both employment and sales growth. We also used TFP instead of labor productivity, a partial measure of productivity, unlike the former. One of the contributions of this study is re-examining the dynamics of the Ethiopian manufacturing sector using updated data and a more robust technique to estimate both sales and employment growths. The other important contribution is its focus on the impact of market concentration on firm exit and the mediating role of firm size and efficiency.

The prevalence of uncertainty and persistent heterogeneity of firms in the context of an unstable and changing environment requires up-to-date empirical research to understand the dynamics of the manufacturing sector in general and firm-level growth in particular (Coad, 2009).Thus, this paper analyzed the growth dynamics of firms in Ethiopian manufacturing with special emphasis on the role of productivity and capital intensity. The growth-productivity nexus has been an important policy issue in industrial dynamics. Wider empirical works showed neutral relationships between firms' productivity and growth while findings are generally mixed (Coad, 2009). Capital intensity was selected as an important variable in view of the government's policy bias towards labor-intensive industries, on the one hand, and firms' potential learning opportunity associated with more capital-intensive technologies, on the other. In short, the study addressed three major questions: 1) Does a high productivity level help firm growth and survival in Ethiopia? 2) How does capital intensity affect firms' growth in sales and employment? 3) How does market structure affect firm exit or survival in Ethiopian manufacturing?

Section 2 of this paper reviews relevant literatures and formulates hypotheses. The third section presents the data and methodology used to test the hypotheses. Section

4 presents results and discussions on the main findings. The last section concludes and suggests policy implications based on the results.

4.2. LITERATURE REVIEW AND HYPOTHESES

Theories on growth dynamics of firms posit that firms vary in their growth prospects depending on their capability of learning. These theories are in line with the evolutionary theory of the survival of the fittest by Nelson and Winter (1982). Penrose's (1959) theory of the growth of firms argues that firm growth is led by an internal force induced through learning-by-doing whereby managers gain more knowledge through time as they are used to their jobs. As managers build their productivity, there are more resources to be freed, which would give firms incentives to grow. Two models of firm growth are worth mentioning in relation to size as they explain the learning behavior of firms in a competitive environment.

The first is the passive learning model of Jovanovic (1982), while the second is the active learning model of Ericson and Pakes (1995). According to the first model, firms do not know their efficiency status with certainty ex-ante, but they only know the distribution of such parameters. Thus, a firm situates its output based on the hypothetical level of its efficiency. If the firm eventually found that its performance is higher than the estimated level, it will update its guess and raise the estimate of output and employment. This mainly prevails among small young firms in relation to the greater uncertainty they face in their estimate than large firms (Jovanovic, 1982).

In the Ericson and Pakes (1995) active learning model, there are two consecutive decisions. The first is whether to exit or remain active in operation. The second is with respect to the level of its investment that can maximize efficiency, which is likely to depend also on the level of investment of its rival and other external shocks. Both the first and the second models have been tested empirically by Pakes and Ericson (1998) and proved relevant but differently between manufacturing and retail sectors. In relation to the firm size–growth relationship, Gibrat's (1931) famous law of proportionate growth has long being tested by many researchers in addition to the two learning models. The law states that firm growth does not correlate with the firm's initial size (Gibrat, 1931). However, empirical studies hardly supported the law.

Mansfield (1962), for instance, indicated that Gibrat's law does not hold in two respects. First, he found that in every industry and time interval, the smaller firms were more likely than the larger ones to die. Second, smaller firms often tend to have higher and patchier growth rates than larger firms. While the first case is more understandable, Mansfield raised question about the reason behind the second case. There are diverse explanations about why small firms grow more than large firms as indicated by many of the empirical findings. The simplest explanation may be due to the fact that large firms are closer to the limits of the market. According to Coad

(2007a), this is related to differences in the characteristics of large and small firms. Unlike small firms that have a more flexible nature, large firms are more routinized, more inert, and less able to adapt. Large firms operate on a large scale since they do not worry much about exit while planning for longer periods compared to the smaller ones whose status is more volatile.

Coad (2007a) found the relevance of the “passive learning” model of industrial evolution based on his observation that small firms follow a quite erratic and noisy growth paths unlike that of larger firms which is relatively stable and smooth. His results, however, showed no evidence in favor of Gibrat’s law. Burghardt and Heim (2015) noted that there has been a voluminous empirical analysis of firm growth since the formulation of Gibrat’s law of proportionate growth. However, similar to the majority of the studies, they failed to confirm the law as they found that establishment growth decreases with an establishment’s initial size and age. Using data from 1994 and 2003, Park *et al.* (2010) found that firm size and age have significant negative effects on firm growth in Korea. Using simulation, Coad and Planck (2012) showed that growth rates are highest when the firm is smallest, but when the firm is larger, there is no clear relationship between firm size and growth. However, Bottazzi and Secchi(2006) claim that the tent shape (double-exponential) distribution of firm growth rates represents an enormously robust characteristic of the manufacturing industry with higher regularity than the one revealed by size distributions.

Using firm-level data from developing countries, Coad and Tamvada (2008) indicated that size and age have a negative impact on firm growth, which they claim to be consistent with prior research on developed countries. Using data in 1985–2006 for 27 EU countries, Oberhofer (2012) found a negative relationship between firm size and age, consistent with other findings. He also indicated that the growth rates of the smallest, youngest, only domestic market-oriented firms are most intensely affected by cyclical movements in relative terms. However, the size of MNE subsidiaries and exporting firms exhibit more stable movement during the business cycle. Using data from Indian manufacturing over the period of 1987–2006, Ghosh (2009) showed that firm growth is negatively related to firm size and in a non-linear way, following an inverted U-pattern. He also indicated that age is negatively related to firm growth in general, while the effect is stronger among older firms (age group 31–50 years).

Goedhuys and Sleuwaegen (1998) found younger firms in Côte d'Ivoire to have grown faster than older firms due to the fact that younger firms possess more learning opportunities to be exploited. They also found that work experience and the age of an entrepreneur have a positive impact on entrepreneurship but have no effect on post-entry performance of the firms. Coad and Tamvada (2011) examined growth of small firms in India using 2002–2003 cross-sectional data of 1.5 million firms. They found that age and size are negatively related to growth of the firms implying that small, young firms tend to grow faster than larger and older firms. They also found this to be more relevant for low-tech firms, particularly firms that use firewood as their power source.

Coad *et al.* (2013) found conflicting results on the nexus between age and firm performance. They showed evidence that older firms experience high levels of productivity, profits, larger size, lower debt ratios, and higher equity ratios, and are better able to convert sales growth into subsequent growth of profits and productivity. On the other hand, older firms appeared to have lower expected growth rates of sales, profits, and productivity. Moreover, older firms were found to be less capable to convert employment growth into sales growth, profits, and productivity than younger firms. From this result, Coad *et al.* (2013) speculated that employment growth is more appropriate in the early ages, while sales growth deserves more focus during the older stages.

With regard to the wide range of findings on size–growth relationship, Capasso and Cefis (2012) argue that exogenously imposed thresholds in firm size distributions are upwardly biased whenever the threshold is determined based on the same variable used to calculate proxies for both size and growth rate. The variable that most studies use in computing these proxies is the number of employees. Using different variables in computing the two variables, Capasso and Cefis (2012) found a negative stable relationship between size and variance in growth rates of firms in the Netherland. In connection with mergers and acquisitions, Burghardt and Heim (2015) found that size of the acquiring firm is positively related to the growth of a newly acquired establishment while the combined size of the establishments is negatively related to growth. From the above review, there seems to be consensus that initially small firms grow faster than large firms, implying the working of the passive learning process. Based on this, we hypothesize:

H1: Small firms grow faster than large firms

However, the above literature also shows differences in the effect of firm age and size on growth. It was indicated that differences in the findings relate to a country's institutional environment, level of development, sector, nature of technology, and so on. For instance, using data from Côte d'Ivoire, Sleuwaegen and Goedhuys (2002) confirmed the negative relationship between a firm's growth, its age, and its size, which is consistent with the learning model of Jovanovic (1982) as firms improve their efficiency over time. However, they found interesting differences in this relationship compared to the growth dynamics of firms in developed countries. In Côte d'Ivoire, small firms grow relatively slower while larger firms grow relatively faster than firms in the west. The other important finding by Sleuwaegen and Goedhuys (2002) is that very few small informal firms appeared to climb up the size-scale ladder better than formally registered ones. Besides, firms that start at a large scale appear to benefit from a different regime with a relatively superior growth performance as they grow older. Other important drivers of firm growth have also been examined in literature either as controls or as important variables of analysis. Some of these are reviewed below.

4.2.1. TECHNOLOGY AND GROWTH

One of the potentially important drivers of firm growth is technology and innovation. Nelson and Winter (1982) suggested that firm growth is closely related to the ability of firms to innovate. Firms with successful innovations were found to grow about twice as rapidly as other comparable firms (Mansfield, 1962). However, results from various recent empirical works are far from reaching consensus. Some studies found no any association between innovation and growth, while others found a negative role of innovation on growth. For instance, Coad and Rao (2008) found that innovation has a negative and significant effect on the growth of firms at the lowest quantiles of growth distribution, while Ghosh (2009) found no association between a firm's innovativeness and its growth. Harrison *et al*. (2013) also indicated that African firms grow more in low-tech than in high-tech manufacturing. Coad (2009) noted that only few fast-growing firms would benefit from their innovation in terms of growth.

However, Del Monte and Papagni (2003) found that, on average, research intensity has a positive effect on the growth rate of Italian firms. More interestingly, the effect of research on firm growth is higher in the traditional sectors than in sectors with high research intensity. However, they found no systematic effect of size level on the growth of firms unlike most of the studies. They also found no any effect of research on other performance variables such as profit rate. Lee (2010) found that the differences in the growth patterns of firms are mainly due to their heterogeneity in technological learning capability. Park *et al.* (2010) found that R&D facilitates both firm growth and survival. In their study on Brazilian firms, Goedhuys and Veugelers (2011) found that innovative performance is an important driver for firm growth. They particularly indicated that firm growth is significantly higher for firms that undertake both product and process innovations.

The firm's technological capability conditions the age–growth relationship that usually appears to be negative. For instance, Lee (2010) explained possible reasons for these mixed results referring to studies that examined innovation based growth of firms. According to him, the aggregate nature of the samples used by the studies that failed to consider firm heterogeneity in technological competence-enhancing capability or inter-industry differences in R&D appropriability or both is the main factor. He noted that cross-country studies on firm growth and technological capability offer supportive proof for the role of firm heterogeneity in technological competence-enhancing capability in mediating the pattern of firm growth. Firms with low technological competence-enhancing capability show negative growth–age relationship while a U-shaped relationship or a positive differential effect is seen for firms with high technological competence-enhancing capability (Lee, 2010).

However, the extent to which firms grow due to their innovation may depend on other factors. For instance, while indicating about the general importance of innovation, Coad and Rao (2008) found that innovation is of greater importance for the fastest-growing firms than low growth firms. Cefis and Marsili (2006) showed that innovation has a positive and significant effect on the probability of firms' survival. Moreover, they found the effect to be increasing with time and is conditional on firm age and size. In line with this, Eiriz *et al.* (2013) suggested the importance of longitudinal case studies involving firms in different stages of their lifecycle to see how innovation impacts. Further, they have built a conceptual framework that helps examine firms' innovation with their respective growth strategies along varying growth stages.

4.2.2. PRODUCTIVITY AND GROWTH

Evolutionary economists argue that more productive firms have better growth and survival probability than less productive ones. This is very desirable, as it would imply that learning is underway in those firms. However, Coad (2009), in his survey of theories and evidence, indicated that this line of thinking is not obviously supported under some circumstances. He mentioned that some firms may want to raise their productivity by shedding employees or downsizing.

Van Biesebroeck (2005) described that in more developed countries, firms follow a life cycle where they enter at a smaller size and with lower productivity. Exit from the industry by mature firms is characterized to follow the order in which declining size precedes declining productivity. Using plant-level panel data from nine SSA countries, he indicated that African firms exhibit divergence in their behavior where small firms face more difficulty in reaching higher level of productivity and growth. He found that firms with high productivity tend to grow faster and have a better chance of survival.

Navaretti *et al.* (2014) indicated that firm growth can be affected by labor productivity, capital intensity, access to finance, age of CEO, and qualification of the labor force. They found that fast-growing firms, in particular, are more strongly affected by these firm characteristics. Specifically, they indicated that young firms create more jobs as a result of their fast growth. Besides, fast-growing firms were found to be more productive, had better access to credit, and were managed by younger CEOs.

Using data in 2001–2010, Du and Temouri (2015) have shown the importance of productivity in enhancing the growth of firms in United Kingdom. They indicated that firms that managed to raise their total factor productivity can easily become high growth firms (HGF). However, Baily *et al.* (1996), Bartlsman and Doms (2000), and Foster *et al.* (1998) found no significant effect of productivity on the growth of the US manufacturing sector. Similarly, Bottazzi *et al.* (2002, 2008), in the context of Italian manufacturing, found no significant effect of productivity on firm growth. On the other hand, Pavcnic (2002) for Chile, Sleuwaegen, and Goedhuys (2002) for Cote d'Ivoire, Liu *et al.* (1999) for Taiwanese electronic firms, and Maksimovic and Philips (2002) have found positive significant effects of productivity on firm growth. Ponikvar and Kejžar (2011) also found that TFP has a positive and strongly significant effect on employment growth among Slovenian manufacturing firms regardless of their levels of technology. If market selection is working and firms are benefiting from the ongoing learning, more productive firms are expected not only to survive but also grow faster than less productive firms. Therefore, we hypothesize:

H2a: Firms with higher productivity grow faster than firms with low productivity

Moreover, high productivity can increase the probability of firm survival. Bellone *et al.* (2008) indicated that profitability and productivity improved the survival of manufacturing firms in France. Similarly, Maksimovic and Philips (2008) and Foster *et al.* (2008) showed a positive significant effect of productivity on survival of firms in the USA. Gebreeyesus (2008) indicated that the probability of survival is higher for high productive firms in the Ethiopian manufacturing sector. Frazer (2005) also found positive and significantly high association between TFP and survival of Ghanaian firms. Therefore, we hypothesize:

H2b: Firms with higher productivity are less likely to exit than firms with low productivity

However, it is well understood that *H2b* can never be claimed always true as evidence suggests. For instance, Söderbom *et al.* (2006) found conditional impact of productivity on survival of manufacturing firms in Ghana, Kenya, and Tanzania. They found a negative but insignificant effect of TFP on exit of firms in contrast to the above findings. However, the effect appeared to vary with firm size. Accordingly, they found that the survival of the fittest holds only among large firms. On the other hand, high TFP was not found to reduce the probability of exit among small firms (Söderbom *et al.*, 2006). Taking this into consideration, *H2b* will be tested on controlling for the impact of firm size.

4.2.3. GROWTH AND PROFITABILITY

Industrial organization literatures convene around the inverse relationship between growth and profitability based on the classical marginal conditions. Firms are assumed to begin with the most profitable business opportunities and maximize their total profit by equating marginal revenue with marginal cost. If a firm opts for growth, the conditions are expected to be disturbed due to additional activities that follow. In contrast to this, evolutionary economists argue that profitability has positive effects on both growth and survival of firms (Coad, 2009). However, empirical evidence has failed to document conclusive results so far.

Using data in 1996–2004 on 8,405 French manufacturing firms, Coad (2007b) found that firm growth improves future profit rates as argued by the evolutionary theory. Coad and Planck (2012) also observed a positive but statistically insignificant relationship between profit and growth. Unlike the classical argument, firms tend to learn over time how to produce more efficiently instead of starting with the most profitable activities. Particularly, periods of growth entail important learning opportunities to firms, while failure to grow implies lack of learning (Coad's, 2007b). Similarly, profitability was found to be positively and significantly associated with sales growth in the Swedish manufacturing sector (Heshmati, 2001).

4.2.4. CAPITAL INTENSITY AND GROWTH

Similar to the size–growth relationship, the role of capital intensity would vary with country conditions, the sector and institutional environment, including market structure. Navaretti *et al.* (2014) examined the age–growth relationship of manufacturing firms in three European nations and found that capital labor ratio is strongly and positively related with firm growth along the growth quantiles of firms. Based on a panel of Slovenian manufacturing firms in 1994–2003, Ponikvar and Kejžar (2011) also found that capital intensity is an important determinant of intensive (TFP) and extensive (employment) growths of firms.

Firm growth also relates to the organizational slackness and a firm's effort for efficient utilization of the existing resources or investment in new capital asset (Coad and Planck, 2012). They added that firms that apply more capital-intensive technology with more intensive utilization of related services, can better exploit scale economies, and hence achieve better growth. Therefore, we hypothesize:

H3: More capital-intensive manufacturing firms grow faster than less capital-intensive firms

It is also possible that the relationship between capital intensity and growth would depend on how growth is measured. For instance, Heshmati (2001) found that capital intensity had a strong positive effect on employment growth of Swedish manufacturing firms, while no such effect was found on sales growth. Therefore, the current study will test H3 both in terms of growth in employment and sales.

4.2.5. MARKET CONCENTRATION AND FIRM EXIT

Literatures have discussed many potential factors behind firm exit and survival. Empirical results would often show varying conclusions depending on different conditions including the methodology used. For example, Ha (2013) found that firms' growth (both in employment and in assets) plays a positive significant role on the survival of firms in Vietnam. Using the Cox proportional hazard model, he showed that the relationship is non-linear and the effect diminishes with firm growth. He also found that firm survival is higher with high presence of foreign firms in a sector perhaps due to spillover effect. Park *et al.* (2010) showed that firm size and age have significant positive impacts on survival of Korean firms. They also indicated that export orientation and R&D improve firm survival.

In the African context, Frazer (2005) documented that high capital-intensive firms in Ghana are less likely to exit as compared to their labor-intensive counterparts. This is likely to be due to technologies embodied in the capital and the corresponding improvement in productivity as Shiferaw (2007) also found that technology and productivity improves the survival propensity of Ethiopian manufacturing firms. The role of productivity has already been captured in *H2b*.

Learning and innovation are, indeed, the most acknowledged source of firm growth and survival, which can in turn affect market structure. Market structure effects determine the dynamics of the selection process between and within sectors. Thompson (2010) indicated that passive learning is associated with increasing industry concentration. In the absence of learning, identical firms have equal market shares at every point in time. He argued that learning can induce ex post heterogeneity, which in turn may raise concentration. Increasing concentration under passive learning appears also to be a phenomenon of imperfectly competitive markets (Thompson, 2010).

Dasgupta and Stiglitz (1988) used a duopoly model with linear industry demand to examine the role of learning on concentration. They indicated that passive learning can even strengthen a small initial cost advantage for one of the firms, to the extent that the disadvantaged firm chooses to exit. This suggests the importance of market concentration on both growth and survival. Shiferaw (2008) found that high market concentration is associated with high exit rate among the Ethiopian manufacturing. He called this finding “counter intuitive” in view of the right-skewed nature of the Herfindah index in the Ethiopian manufacturing indicating that the sector is dominated by firms with lower market shares. We re-examine this finding by using different measure of concentration and recent data. Accordingly, we hypothesize:

H4: Firm exit is higher in more concentrated sectors than in less concentrated sectors

Sleuwaegen, and Goedhuys (2002) found that small and medium sized firms face higher exit rates in Côte d'Ivoire. In the case of Ethiopia, Shiferaw (2008) described that a potential reason for high risk of exit in more a concentrated market is the competitive pressure of few large firms that would make small firms lose their battle for small market shares. However, he did not go further to show empirically though it would have been helpful to do so. Based on this, we push *H4* further accounting for the role of firm size and efficiency. The following auxiliary hypotheses will be tested.

H4a: In concentrated sectors, smaller firms face higher exit rate than larger firms

H4b: In concentrated sectors, firms with higher efficiency gap face greater risk of exit than firms lower efficiency gap

From the above empirical evidence, it is clear that studies in less developed countries are underrepresented. This forced us to use studies conducted in more advanced countries to better support our hypotheses, though it is difficult to compare firm dynamics under different contexts. But the stylized facts indicate similar effects in some respects while there are heterogeneities in many cases.

4.3. DATA AND METHODOLOGY

4.3.1. DATA SOURCE

In order to test the above hypotheses, we used the census of manufacturing establishments in Ethiopia gathered by the Central Statistical Agency (CSA). For our purpose, we utilized only data in 2000–2011, which is unbalanced. The data contains detailed information about firms in the manufacturing sector who employs 10 and above permanent workers. Important variables like firm's sector, sales, years of establishment, ownership, initial paid up capital, current paid up capital, industrial and non-industrial costs, export sales, import of raw materials, inputs used, investment in fixed assets, merchandize inventory, etc. are available in the dataset. Secondary data from the World Development Indicator were also used as the additional source most importantly for the purpose of deflation in variable construction. We used two-digit International Standard Industrial Classification (ISIC) for the purpose of computing sectoral variables and comparison of sectoral performance.

The data for the main empirical analysis does not include all enterprises in the original data set. First we excluded enterprises with doubtful figures and missing values on the major variables like sales, employment, capital, etc. Besides, since the data is unbalanced, we included enterprises with two and above observations as required by the major econometric model. The data include both private and public-owned firms operating in 14 two-digit classified industrial sectors. These are manufacturing of foods and beverages, textile, wearing apparel, leather and leather products, wood products, paper products, chemicals, rubber and plastic, other non-metallic minerals, basic iron and steel, fabricated metal, machinery and equipment, motor vehicles and trailers, and furniture.

4.3.2. DESCRIPTION OF VARIABLES

Size: the natural legalism of the number of permanent full-time employees of a firm

lnage: the natural logarithm of firm age as measured by the number of years since the time a firm started operation

TFP: total factor productivity estimated using the semi-parametric approach of Levinsohn and Petrin (2003)

*Foreigner:*a dummy for *foreign ownership* constructed by assigning value one if foreigners have stock in the current total paid-up capital of a firm and zero otherwise

*Private:*a dummy for *Private ownership* variable constructed by assigning value one if the ratio of government paid-up capital to the current total paid-up capital of a firm is lower than 0.5 (50%) and zero otherwise. We used this categorization even if there is a separate variable that captures this ownership issue in the dataset due to inconsistencies observed in the dataset and difficulties in differentiating some of the enterprises as either private or public in some cases for Ethiopia.

CI: stands for Concentration Index, a sectoral variable constructed as the sum of the first four largest firms' market share in the sector, which can be given as (similar to Jung and Lee's (2010) top firm dominance)

$$CI = \frac{\sum_{i=1}^{4} q_{ij}}{Q_j}$$

where q_{ij} is the market share of firm i in sector j and i running from 1 to 4 indicates that the first four largest firms in market share are taken. $Q_j$is the total sales of sector j. Note that CI was computed using all firms in the country to reveal the real competition in the manufacturing sector.

export: a firm-level variable assigned value 1 if the firm is engaged in export and 0 otherwise

ln(K/L): the natural logarithm of capital-labor ratio computed as the ratio of firm's capital to the number of permanent employees; where "L" is the labor input of a firm measured in terms of the number of total employees of the firm, and "K" is the capital input of a firm computed using the formula

$$K_{it} = K_{it-1} + \frac{Inv_{it}}{capD_{it}} - D_{it} - disposed_{it}$$

where *inv* is investment in capital during a year, D is depreciation during the year and *disposed* is capitals disposed of during the year, and *capD* is an implicit fixed capital deflator computed from the World Bank's database on capital formation. It is computed as the ratio of gross capital formation at current local currency to gross capital formation at constant local currency (using year 2000 prices as a base). The *i*, *0,* and *t* subscripts stand for firms' identity, initial year, and time period, respectively.

HEFFG: represents dummy for high efficiency gap (difference between the efficiency score of a given firm and the maximum efficiency score in a two-digit sector). Efficiency scores were computed after estimating stochastic frontier model following Wang and Ho (2010).

4.3.3. THE EMPIRICAL MODELS

In order to measure the performance of firms in the Ethiopian manufacturing sector, we use four measures of performance. These are sales growth and total factor productivity (TFP). In this section, we present the estimation strategies of each measure.

The sales growth model

The basic model we adopted to estimate growth equation follows Evans (1987) who specified the growth equation as:

$$(lnS_{t'} - lnS_t)/d = lng(A_t, S_t, B_t) + u_t \qquad 4.1$$

where *S*is sales *t' >t and d = t'-t.* A, S, B, and g denote age, size, the number of plants, and growth function, respectively, and u_t is error term. Including age and size has become a wise practice in any firm-level growth equations. Like Lee and Temesgen (2008), however, we included lagged value of sales in the RHS variables instead of current sales as it could be used to test Gibrat's law. If the coefficient of this variable is significant, it can be concluded that Gibrat's law does not hold (Evans, 1987). We computed the sales growth rate similar to Lee and Temesgen (2008). This study, however, has an advantage over that of Lee and Temesgen (2008) as it uses a panel data with a 10-year span. The estimated sales growth equation on important firm and sector characteristics is given as

$$\ln\left(\frac{S_t - S_{t-j}}{S_{t-j}}\right) = f(size_{t-1}, \textit{age, export, K/L, TFP, CI, Private, Foreign, sector, year}) \qquad 4.2$$

where S_t is sales in year *t,* S_{t-j} is *j* period lagged value of sales, and ε is a stochastic error term. The variables in the RHS include age of the firm, lagged value of firm size, export dummy, concentration index(CI), total factor productivity (TFP), and dummies for private ownership, foreign ownership, year, and sector. Growth (the left hand side of (4.2)) is computed in such a way that any prior value of sales is taken in cases where one year lagged value is missing while computing changes between two consecutive periods. In addition to equation (4.2), we used job growth equation, which is computed as,

$$\ln(emp_{it}) - \ln(emp_{it-1}) = f(size_{t-1}, age, export, K/L, TFP, CI, Private, Foreign, sector, year \ldots 4.3$$

where emp_{it} is the total number of permanent employees of firm "i" at year "t" and emp_{it-1} is the lagged value of emp_{it}.

However, there are problems in estimating equations (4.2) and (4.3) using OLS and fixed or random effect models due to the correlation of the lagged value of growth with the fixed effect in the error term giving rise to what is called dynamic panel bias (Roodman, 2009). The RHS variables would not be exogenous as they are required to obtain consistent estimators. Thus, there will be endogeneity and reverse causality is inevitable. Time-invariant firm characteristics (fixed effects), such as sector and managerial skills, may be correlated with the explanatory variables.

Roodman (2009) indicated that some of the approaches like least square dummy variable (LSDV) and instrumental variable solve the problem partially. Specifically, he pointed out that LSDV works only for balanced panels and does not address the potential endogeneity of other regressors. Arellano and Bond (1991) developed a generalized method of moment (GMM) technique that eliminates the bias through transformation of the variables. Furthermore, Blundell and Bond (1998, 2000) improved the estimation method noting that the validity of instruments from first differencing transformation may suffer in cases where input and output variable are persistent. They developed a system GMM that uses more moment conditions from lagged first difference of the dependent and independent variables. In this paper we specifically used a one-step system GMM with heteroscedasticity-consistent standard errors.

According to Roodman (2009), of the two available transformations namely, different transformation and forward orthogonal deviations, the former has limitations, especially in the case of unbalanced panel data since it leads to loss of some data due to the transformation. Thus, we apply the second option for unbalanced data, which is computable for every observation except the last for each firm thereby minimizing loss of data. After the system GMM estimation, we apply the Arellano and Bond tests of autocorrelation and the Sargan/Hansen test for joint validity of the instruments that are standard after GMM (Roodman, 2009). The final estimating equation is given by:

$$\begin{aligned} g_{it} = \beta_0 + \beta_1 size_{it-1} + \beta_2 lnTFP_{it} + \beta_3 \ln(K/L)_{it} + \beta_4 lnage_{it} + \beta_5 Foreign_{it} \\ + \beta_6 private_{it} + \beta_7 CI_{jt} + \beta_8 export_{it} \\ + \beta_9 \delta_j + \beta_{10} T + \varphi_{it} \end{aligned} \qquad 4.4$$

where g_{it} denotes firm growth (sales or employment growth) as the dependent variable; *export* is dummy for export; *lnage* is the natural logarithm of age of the firm since its establishment; *Foreign* is dummy for foreign ownership; δ_j is dummy for sector *"j"*; *T is* year dummies; andφ is a random error term. Variables *lnage, export, Foreign, private, CI,* and the dummies for year and sector are included to control for heterogeneity of firms. We added year dummies to capture macro productivity shocks and two-digit industry affiliation to account for the sectoral effect of growth.

Panel probit was applied to estimate firms' exit probability including the potential determinants of exit or survival. Survival equations are often estimated using hazard models like the Cox proportional hazard model if the interest is on survival time. However, since our interest is on what determines exit, we used a probit model to estimate exit probability based on the following equation (4.5).

$$\begin{aligned} Exit_{it} = \alpha_0 + \alpha_1 size_{it-1} + \alpha_2 lnTFP_{it-1} + \alpha_3 \ln(K/L)_{it-1} + \alpha_4 lnage_{it-1} \\ + \alpha_5 CI_{jt-1} + \alpha_6 Private_{it-1} \\ + \alpha_7 export_{it-1} + e_{it} \end{aligned} \qquad 4.5$$

In (4.5), *Exit* is a binary variable assuming value "1" if a firm exits in year "t," and "0" otherwise; α are parameters to be estimated; e_{it} is the error term that constitute two components. Other variables assume the definitions given earlier. One year lagged values of all the explanatory variables were taken to consider firm characteristics before exit. In order to test the extended hypothesis on firm concentration, interactions of CI with size and efficiency (i.e CIxSZED and CIxHEFFG) were added in equation (4.5) CIxSZED is the interaction between CI and dummy for large firms (firm with above mean size). CIxHEFFG is the interaction between CI and dummy for high efficiency gap of firms (HEFFG).

4.4. RESULTS AND DISCUSSION

This chapter presents the results of the empirical analyses on firm growth and exit, focusing on the role of productivity and capital intensity. It also discusses the impact of firm age, size, and market concentration on growth and survival. Inclusion of the first two variables has become a wise practice in all studies on firm growth while concentration is also important, especially with respect to firm exit. Their importance will be discussed in relation to firm-level learning models. Descriptive statistics (Table 4.1) show that the mean age, size, and TFP of the firms in the sample were 2.36, 3.43, and 6.69 log points, respectively. The average growth rates of firms in terms of sales and employment were 2 and 4%, respectively. Regression results on growth and exit are presented below in their respective order.

Variable	Obs	Mean	Std. Dev.	Min	Max
Sales growth	8904	0.02	0.09	-0.58	0.87
Employment growth	8080	0.04	0.35	-0.84	7.04
lnage	11211	2.36	1.07	0.00	4.11
size	11211	3.43	1.33	0.69	8.40
lnTFP	11211	6.69	1.01	-0.78	13.33
ln(K/L)	11211	9.87	1.84	1.12	17.89
export	11211	0.05	0.22	0.00	1.00
CI	11211	0.48	0.18	0.25	1.00
private	11211	0.91	0.28	0.00	1.00
Foreign	10003	0.04	0.20	0.00	1.00

Table 4.1 Descriptive statistics

4.4.1. RESULTS OF GROWTH REGRESSIONS

Tables 4.2 and 4.3 present results from the econometric analysis on sales and employment growths, respectively, based on the dynamic panel data system generalized method of moment (SYSGMM), fixed effect (FE), and the pooled ordinary least square (POLS) approaches. The last two approaches were included only for checking the robustness of results from the SYSGMM, which is the main approach in this paper. Therefore, all interpretations and final conclusions were derived based on the SYSGMM. The main variables of interest are size, TFP, and capital intensity (K/L) while the rest were included as controls.

We estimated growth based on both sales and employment for two reasons. One is to see the robustness of firm growth in both respects and to make sure that using employment as a proxy for size entails similar results in both growth equations. The second reason is to make sure that the bias Capasso and Cefis (2012) suspected to happen does not pose any problem. Capasso and Cefis (2012) indicated that there is upward bias in the coefficient of initial size of a firm while estimating the relationship between firm growth and size when employment is used to compute both growth and size proxies. In addition to this, we estimated equations for all firms in the sample and for surviving firms separately. The standard errors used in the FE models are clustered in the number of firms. The SYSGMM estimation results were proved healthy as the Arellano and Bond (1991) test (AR(2)) of autocorrelation shows absence of second order autocorrelation. Besides, the Hansen test of over identifying restriction shows acceptance of the null hypothesis that “all the instruments used are valid.” Results are presented in Table 4.2 (sales growth) and Table 4.3 (employment growth) with robust standard errors.

Results in Table 4.2 indicate that lagged firm size ($size_{t-1}$) negatively and significantly affects sales growth as opposed to Gibrat's (1930) law but in line with most of the previous studies. It means that small firms grow faster than large firms in accordance with our hypothesis (*H1*). Different explanations have been given in literature on the negative effect of initial size on growth. The theoretical models (Jovanovich, 1982; Ericson and Packes, 1995) explain this effect as the sign of learning in firms. The two other important variables, TFP and capital intensity were found to have positive and significant (at less than 1% level) effect on sales growth in support of *H2a* and *H3*. These indicate that high productive firms and more capital intensive firms grow faster than firms with low TFP and low capital intensity. Results are robust upon running regression on all firms and on surviving firms. The finding is in agreement with that of Bigsten and Gebreeyesus (2007) with respect to the impact of productivity. According to Coad (2007b), if growth in firm size follows a steady growth in productivity of the firm, it can be seen as the effect of “learning-by-doing.”

Among the control variables, the coefficients of *export* and *Foreign* are positive and significant. This shows that exporting firms grow faster than non-exporting firms, implying “learning-by-exporting.” The positive significance of '*Foreign*' in the SYSGMM indicates that foreign-owned firms grow better than their domestic counterparts. This result is expected as foreign firms tend to be more productive, competent, and own better technology. The negative and strongly significant coefficient of the variable “*private*” shows that public-owned firms grow better than private firms. The negative effect of age on growth was also observed with respect to the sales growth supporting the empirical regularities in this respect. This suggests the fact that young firms grow faster than older firms mainly because of their better flexibility and capital vintages (Thompson, 2010). Market concentration (CI) appeared to have no significant effect on sales growth.

Sales growth	Sales growth (all firms)			Sales growth (surviving firms)		
	SYSGMM	FE	POLS	SYSGMM	FE	POLS
	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)
$size_{t-1}$	-0.030*** (0.003)	-0.031*** (0.003)	-0.017*** (0.001)	-0.029*** (0.003)	-0.032*** (0.003)	-0.017*** (0.001)
lnTFP	0.047*** (0.004)	0.055*** (0.002)	0.039*** (0.002)	0.046*** (0.004)	0.055*** (0.002)	0.038*** (0.002)
ln(K/L)	0.010*** (0.002)	0.009*** (0.001)	0.002*** (0.001)	0.009*** (0.002)	0.009*** (0.001)	0.002*** (0.001)
export	0.024*** (0.010)	0.016** (0.008)	0.013*** (0.005)	0.024** (0.010)	0.021** (0.008)	0.012*** (0.005)
lnage	-0.002 (0.002)	-0.031*** (0.007)	-0.005*** (0.001)	0.000 (0.002)	-0.031*** (0.008)	-0.003** (0.001)
CI	-0.006 (0.038)	0.033 (0.028)	0.001 (0.024)	0.005 (0.039)	0.026 (0.029)	0.012 (0.025)
private	-0.024*** (0.007)	-0.011 (0.008)	-0.006* (0.004)	-0.024*** (0.007)	-0.010 (0.008)	-0.005 (0.004)
Foreign	0.018** (0.008)	0.008 (0.007)	0.002 (0.005)	0.018** (0.008)	0.007 (0.007)	0.003 (0.005)
_cons	-0.275*** (0.038)	-0.238*** (0.033)	-0.184*** (0.015)	-0.294*** (0.038)	-0.231*** (0.035)	-0.193*** (0.015)
Dummies	Year & sector	Year	Year & sector	Year & sector	Year	Year & sector
No. of obs	7563	7563	7563	6929	6929	6929
No of firms	2122	2122	2122	1940	1940	1940
No. of inst	776			785		
AR(1)	0.000			0.000		
AR(2)	0.142			0.127		
Hansen test	0.171			0.326		

Table 4.2 Sales growth regression

***, **,* represent significance at 1, 5, and 10% levels, respectively

Table 4.3 depicts that the effects of size, TFP, and capital intensity on firm growth have remained similar when growth is measured in terms of employment (or job) apart from sales. However, the coefficients of *size* in job growth appeared to be far larger than in case of sales growth. Moreover, the effect of TFP and capital intensity looks very sensitive to specifications in employment growth. In the SYSGMM and POLS, the effect of TFP exhibited strong positive significance similar to the sales growth model while FE results show something different perhaps due to the fact that no sector dummies were included. Capital intensity has shown a positive significant effect only for the whole sample in the SYSGMM specification. In case of surviving firms, the coefficient is not significant though positive like that of sales growth. This result is not very strange due to the likely impact of substituting capital for labor. Generally, it seems that results are not robust on the positive impact of capital intensity on employment growth.

	Employment growth (all firms)			Employment growth (survivors)		
	SYSGMM	FE	POLS	SYSGMM	FE	POLS
	Coef. RSE	Coef. RSE	Coef. RSE	Coef. RSE	Coef. RSE	Coef. RSE
$size_{t-1}$	-0.170***	-0.393***	-0.125***	-0.168***	-0.381***	-0.124***
	(0.014)	(0.015)	(0.007)	(0.013)	(0.014)	(0.007)
lnTFP	0.031***	-0.002	0.026***	0.033***	-0.005	0.025***
	(0.011)	(0.007)	(0.006)	(0.011)	(0.008)	(0.007)
ln(K/L)	0.015**	-0.042***	-0.005**	0.010	-0.042***	-0.005*
	(0.008)	(0.005)	(0.003)	(0.008)	(0.005)	(0.003)
export	0.143***	0.085***	0.136***	0.144***	0.096***	0.138***
	(0.035)	(0.025)	(0.015)	(0.038)	(0.025)	(0.015)
lnage	0.031***	0.095***	0.016***	0.029***	0.089***	0.015***
	(0.007)	(0.024)	(0.004)	(0.007)	(0.024)	(0.005)
CI	-0.173	-0.008	-0.071	-0.149	-0.031	-0.030
	(0.161)	(0.124)	(0.110)	(0.157)	(0.127)	(0.119)
private	-0.226***	-0.085***	-0.157***	-0.227***	-0.082***	-0.157***
	(0.031)	(0.019)	(0.013)	(0.032)	(0.019)	(0.014)
Foreign	0.050*	0.058***	0.050***	0.050*	0.051**	0.049***
	(0.028)	(0.022)	(0.013)	(0.029)	(0.022)	(0.014)
_cons	0.511***	1.756***	0.550***	0.453***	1.764***	0.535***
	(0.129)	(0.125)	(0.061)	(0.130)	(0.126)	(0.064)
Dummies	Year & sector	Year	Year & sector	Year & sector	Year	Year & sector
No. of obs	7563	7563	7563	6929	6929	6929
No of firms	2122	2122	2122	1940	1940	1940
No. of inst	981			981		
AR(1)	0.000			0.000		
AR(2)	0.268			0.275		
Hansen test	0.179			0.273		

***, **,* represent significance at 1, 5, and 10% levels, respectively

Table 4.3 employment growth regressions

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The striking difference is with respect to the effect of age on employment growth. Unlike its effect on sales growth, age was found to have a strong positive effect on employment growth. This result shows that old firms create more jobs than young firms. This could be related to the fact that older firms tend to be larger in size than new entrants. However, previous empirical results show a negative effect of age in most of the cases, while Bigsten and Gebreeyesus (2007) found no significant effect of age on job growth. Navaretti *et al.* (2014) indicated that the effect of age is positive and significant on the growth of firms only at the lowest quantile while it started to be negative and significant after the second quantile (0.25) of growth distribution in the European firms.

Market concentration plays a negative but insignificant role in job growth. The impact of exporting also remains positive on job growth similar to its effect on sales growth. The negative effect of private ownership is far stronger in job growth than sales growth, indicating that job growth is more prevalent in public firms. This is in line with the facts on the ground in the Ethiopian manufacturing sector where public enterprises employ a larger number of workers regardless of the scale of operation and they are relatively larger as compared to private firms.

In both sales and job growth regressions, we found a negative relationship between size and growth of firms as was expected. This result is consistent with Sleuwaegen and Goedhuys (2002) who found strong support for the learning effect of Jovanovic's (1982) model. TFP was also found to have positive significant effects on growth in both regressions. It indicates that high productive firms are superior in both job and sales growth confirming our second hypothesis *(H2a)*. Capital intensity appeared to have a strong positive effect on sales growth. This result could be related to efficiency gains from high capital intensity due to technologies embodied in the capital and associated learning.

Productivity, concentration, and firm exit

In order to examine the determinants of firm exit in the Ethiopian manufacturing sector, exit regressions were estimated based on equation (4.5) using panel probit. Variables in the RHS of the equation were entered by taking their one year lagged values to allow for pre exit characteristics. However, we added no indicative subscripts on the variables shown in the estimation results presented in Table 4.3 for the sake of simplicity. Sector dummies for 14 two-digit industries were included in all estimations. Results are presented in four columns. Column 1 reports the basic exit equation meant for testing hypotheses *H2b* and *H4*. Columns 2 and 4 present results that include interaction terms to test H4a and H4b. Column 3 shows results when dummy for high efficiency gap (DEFG) is separately included before estimating Column 4. The efficiency gap is the gap a given firm has in technical efficiency from the frontier firm in a two-digit sector.

Dependent Variable: exit				
	(1)	**(2)**	**(3)**	**(4)**
lnage	-0.214***	-0.215***	-0.215***	-0.226***
	(0.020)	(0.020)	(0.020)	(0.021)
size	-0.085***	-0.092***	-0.087***	-0.082***
	(0.020)	(0.029)	(0.022)	(0.024)
lnTFP	-0.047**	-0.047**	-0.047**	-0.030
	(0.022)	(0.022)	(0.022)	(0.025)
ln(K/L)	-0.034***	-0.035***	-0.035***	-0.025*
	(0.012)	(0.012)	(0.012)	(0.013)
export	-0.043	-0.042	-0.044	-0.088
	(0.116)	(0.117)	(0.117)	(0.123)
Private	-0.007	-0.008	-0.007	-0.093
	(0.093)	(0.093)	(0.093)	(0.090)
CI	0.477***	0.463***	0.473***	0.245
	(0.114)	(0.122)	(0.116)	(0.278)
DEFG			-0.011	-0.233*
			(0.054)	(0.136)
CIxSZED		0.044		
		(0.132)		
CIxHEFFG				0.571**
				(0.261)
_cons	-0.196	-0.167	-0.172	-0.217
	(0.229)	(0.246)	(0.259)	(0.294)
No of obs.	8080	8080	8080	8080
No. of firms	2177	2177	2177	2177
Log likelihood	-2223***	-2223***	-2223***	-2209***

Table 4.4 Firms' exit regressions (panel probit)

***, **,* represent significance at 1, 5, and 10% levels, respectively

As can be seen from Table 4.4, the coefficient of lnTFP is negative and strongly significant in determining exit as was expected in *H2b*. This indicates that firms with higher productivity are less likely to exit than firms with lower productivity. The strongly positive significance of the coefficients of concentration index (CI) shows results in favor of *H4* and in perfect agreement with Shiferaw (2008), though he used a different measure (Herfindahl index). This indicates that firms in a more concentrated sector are more likely to exit, perhaps due to high competitive pressure from large firms in the sector. However, further examination is needed to see which firms are more likely to exit. Based on the theoretical ground that small firms or less efficient firms are the immediate victims, further examination was conducted by introducing interaction terms of size and efficiency gap with CI in the exit regressions.

Column 2 included interaction between CI and dummy for large size (CIxSZED) in addition to the main variables. Against our expectation (hypothesis H4a), the coefficient of the interaction term was found to be positive and statistically insignificant. This indicates that once size is controlled for in the general model setting, no differential impact of firm size was observed in more concentrated sectors. The coefficient of the interaction between concentration and efficiency gap (CIxHEFFG) (column 4) appeared to be positive and significant at less than 1% level implying that the effect of market concentration on firm exit is stronger for firms with high efficiency gap than firms with lower efficiency gap confirming our hypothesis (H4b). However, efficiency gap (DEFG) does not seem to have any effect on exit if included separately (Column 3). This means that efficiency or technological competence is key for survival of firms in more concentrated sectors. Comparing with results in Column 2, we can say that it is not firm size that matters for firm survival in concentrated sectors as some scholars (Shiferaw, 2008) suggested. We proved that efficiency is the most important factor for a firm to survive in a more concentrated sector regardless of its size. This result suggests the fact that selection on efficiency, or “creative destruction" (Söderbom *et al.*, 2006), is driving firm dynamics in Ethiopian manufacturing.

Regarding the effects of control variables, results show that small firms and young firms are more likely to die or exit than large and old firms as the coefficients of *size* and *lnage* are negative and strongly significant. Literature shows that it is often difficult to disentangle the effect of these two variables. Similar to its effect on growth, capital intensity turned to have a negative significant effect on firm exit. However, private ownership and export participation seem to have any significant effect though their coefficients are negative.

From the overall findings, we can now conclude that small firms, young firms, firms with lower productivity, and firms with lower capital intensity are more prone to exit. This is in line with most of the empirical studies reviewed by Coad (2009) and other works reviewed in this paper. In other words, firms with high productivity, high capital intensity, and larger size are less likely to die than the otherwise groups due to the corresponding effect of learning. Firms in more concentrated sectors are more likely to exit than those in less concentrated sectors. This effect was found to be stronger among less efficient firms. Since the efficiency gap was measured within the same sector, firms with a high efficiency gap from the frontier were more vulnerable to exit.

4.5. CONCLUSION

This paper examined firm growth and survival in the Ethiopian manufacturing sector using firm-level census data in 2000–2011 for medium and large manufacturing with 10 and above permanent employees. Firm growth and survival were analyzed, controlling for firm heterogeneity in terms of size, age, sector, ownership, and other important variables. The analysis was made using descriptive and econometric tools. In the growth regression we looked at both sales and employment growths and used a dynamic panel data framework introduced by Blundel and Bond (1998) that can take the likely effect of endogeneity of the independent variables. We have also examined exit probability of firms using panel probit regression.

Results indicate that firm size and age are negatively associated with firm growth, implying the existence of Jovanovich's (1982) passive learning phenomena. However, the negative effect of age on growth does not hold for job growth. It was rather found to have a positive and significant effect on job growth. As per our hypotheses, results showed that firms with high productivity and high capital intensity recorded better growth rates. Exporting firms and firms owned by foreigners are better in their growth. Productivity and capital intensity were found to be helpful in improving the survival probability of firms. Older firms and large firms are also less likely to exit. Firms in more concentrated sectors are more likely to be competed out. In furthering this analysis, we found that there is no significant interaction between concentration and firm size, which disproved Hypothesis *4a*. Instead of small firms, less efficient firms in more concentrated sectors are the ones that are prone to death while more efficient firms appeared to be more likely to survive.

The main contribution of this paper is that unlike the previous works in Ethiopia, it comprehensively analyzed both growth and exit of firms using recent data and robust tools of analysis. Unlike the mixed results in past studies, we found robust positive effect of productivity on firms' growth (in both sales and job). The finding that firms in more concentrated sectors face greater exit probability seems strange, as it was also noted by Shiferaw (2008), in the sense that it is in a more competitive market that firms would face higher chances of exit. However, this could also be related to the impact of passive learning as Thompson (2010) suggested that learning increases market concentration due to the fact more successful firms capitalize on their market share while less successful ones could be forced to exit. The major contribution of this study is that it has identified the differential impacts of size and efficiency for survival of firms in more concentrated sector. It was found that firms with relatively lower efficiency gap have a greater opportunity to survive in concentrated sectors. However, firm size does not affect exit in more concentrated sectors. It means that even a small firm with higher efficiency can have a better opportunity to survive than a large but inefficient firm.

Finally, the policy implications derived from the findings suggest that improving productivity, and efficiency, and helping firms in their access to better capital input can increase growth and reduce exit rate. Finding ways to facilitate the growth of firms from lower level to the next stage should be a policy priority for a stable and progressive development of the industrial sector. Based on the evidence that large firms create not only more number but also more stable jobs (Coad, 2007a) and the fact that large firms have better potential in adopting new technologies, it is important to provide the required support for large firms too, while taking good care to not compromise the ease of entry of new firms.

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CHAPTER 5. EMBODIED TECHNOLOGY TRANSFER AND LEARNING-BY-EXPORTING IN THE ETHIOPIAN MANUFACTURING SECTOR

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ABSTRACT

This paper examined the role of imported inputs, new capital goods, and exporting on firm performance using micro data collected in 2000–011 from manufacturing firms with 10 and more permanent employees in Ethiopia. Performance was measured in terms of labor productivity, total factor productivity (TFP), and TFP catch-up. In this paper, we argue that technologies embodied in imported inputs and new capital goods and export orientation are the crucial sources of learning and innovation that enhance performance of firms in less-developed countries. The hypotheses developed along this argument were econometrically tested by applying a dynamic panel data technique. Results indicate that exporting, greater use of imported inputs, and new capital goods significantly improved the productivity and TFP catch-up of firms. The positive productivity effects of imported inputs and new capital goods appeared to be higher for exporters than non-exporters. New capital goods were seen to play a greater role in embodied technology transfer than imported inputs. The findings generally suggest that improving access to imported inputs, encouraging investment in new capital goods, and strengthening export orientation among manufacturing firms can help accelerate technology transfer and build local innovation capabilities toward Ethiopia's desired structural transformation.

Keywords: manufacturing firms, importing, exporting, new capital goods, productivity, technology transfer.

5.1. INTRODUCTION

International trade plays a crucial role in the process of structural transformation of developing countries (Bernard *et al.*, 2007; Schiff and Wang, 2010) by enhancing diffusion of technologies (Aghion and Jaravel, 2015) as the main driver of innovation and productivity growth in most countries (Keller, 2004). Effective diffusion of technologies in a globalizing world creates convergence (Aghion and Jaravel, 2015) by accelerating structural transformation as was witnessed by the success of East Asian economies especially in expanding their production and exports of electronics and telecommunication equipment (Freeman, 2011). Increased share of manufactured goods in total export and opening domestic markets for imported goods and foreign investment were among the major success factors for China (World Bank, 2012).

Exporting manufactured goods can improve firm performance in many ways including increased competition, technology or knowledge spillovers following improved information flows, overseas supplier-customer relation, widened market opportunities, scale economies, and export related policy incentives (Bernard and Jensen, 1999; Wagner, 2002; Van Beisbroeck, 2005; Kugler and Verhoogen, 2009). However, empirical findings have remained mixed and vary with country contexts and methodologies, making cross-country comparisons and even cross-study comparisons for one country difficult (Wagner, 2007).Evidence shows that firms from developing countries generate more benefits from exporting compared to firms from developed countries. In Africa, both multi-country studies (Mengistae and Pattillo, 2004; Van Beisbroeck, 2005; Bigsten and Söderbom, 2010) and country-specific cases such as Bbaale (2011) for Uganda, and Bigsten and Gebreeyesus (2009) for Ethiopia, suggest that exporting increases firm productivity. However, there exist asymmetric results even within a country. In the case of Ethiopia, for instance, Siba and Söderbom (2011) failed to confirm the evidence of “learning-by-exporting” unlike Bigsten and Gebreeyesus (2009).

Importing also increases firm performance by improving access to better quality capital and intermediate goods produced in advanced countries. These goods are known to be the major source of innovation and productivity in less-developed countries (Paul and Yasar, 2009). Particularly, intermediate inputs increase productivity by improving product quality and reducing cost of production (Kasahara and Rodrigue, 2008). They also play a greater role in international diffusion of technology than exporting (Keller, 2004). Increasing dominance of intermediate goods in international trade (Subramanian and Matthijs, 2007) suggests its growing importance in facilitating technology transfer. Despite this fact, not enough studies exist on the impacts of imported inputs in developing countries (Wagner, 2012; Damijan and Kostevc, 2015).

In the sub–Saharan Africa (SSA) context, we know only the work of Bigsten *et al.* (2013), which showed that reducing import tariff increased the productivity of input importers. However, this study ignored the potential interactions between exporting and importing in addition to their separate effects on productivity (Kugler and Verhoogen, 2008, 2009; Aristei *et al.*, 2012). Foster-McGregor and Isaksson (2014) provided the first ever evidence on the role of importing, exporting, and two-way trade on productivity of firms in 19 SSA countries. However, the estimated effects cannot be free of bias arising from endogeneity due to using cross-sectional data. Moreover, not controlling heterogeneity among countries, mainly with respect to their levels of development (Wagner, 2012), absorptive capacity (Yasar, 2013; Augier *et al.*, 2013), and market concentration (Jacob and Meister, 2005) can lead to biased estimates. Particularly, ignoring the effect of market concentration was seen to inflate firm productivity in Africa (Gelb. *et al.*, 2014). To the best of our knowledge, no studies in SSA have yet considered analyzing the productivity effect of new capital goods with importing and exporting. Studies in Ethiopia have largely focused on the impact of exporting but their findings have remained inconclusive.

Against this backdrop and the theoretical underpinnings from international trade literatures, this paper examines the role of trade on the performance of manufacturing firms in Ethiopia. It tries to answer three major questions. 1) Does greater use of imported inputs improve firm performance? 2) Is there transfer of technologies embodied in capital goods? 3) Is there evidence of learning-by-exporting? To answer these, data from the annual census of large and medium manufacturing firms in 2000–2011 are analyzed with a combination of dynamic panel data econometrics and matching techniques. Performance is measured with labor productivity, total factor productivity (TFP), and TFP catch-up.

Regression results indicate that imported inputs, new capital goods, and exporting have positive significant effects on all measures of performance. Results of the matching technique also confirm all the effects but not that of imported inputs on TFP. The productivity effects of imported inputs and new capital goods appear to be higher among exporters than non-exporters. This study contributes both theoretically and empirically in four ways. First, unlike previous studies, it examines how international trade affects the productivity of Ethiopian firms in relation to diffusion of technologies borrowing the idea that "convergence towards the upper end of the productivity spectrum can equally be seen as a process of diffusion…" (Gelb *et al.*, 2014). It shows the strong learning potential that underlies importing, exporting, and investing in capital goods. Second, the study rigorously proves that new capital goods play a greater role in embodied technology transfer than imported inputs. Third, it provides strong evidence of "learning-by-exporting" not only in terms of the direct productivity effect of exporting but also indirectly by enhancing returns out of using more imported inputs and new capital goods. Finally, it is the first study in SSA to have assessed firm-level learning in terms of intra-industry catch-up along with TFP and labor productivity. Using the catch-up variable gives a better view of performance from the evolutionary theory perspective.

The rest of the paper is organized as follows. Section 5.2.1 presents a review of relevant literature and discusses the hypotheses. The data and methods used to analyze the data are described in Section 5.2.3. The results are presented and discussed in Section 5.2.4 and the paper concludes in Section 5.2.5 by drawing some implications based on the findings.

5.2. LITERATURE REVIEW AND HYPOTHESES

5.2.1. THEORETICAL BACKGROUND

According to new growth theories (Romer, 1990; Aghion and Howitt, 1992), technology plays a key role in long-run term economic growth. Productivity variations between countries are largely explained by differences in the countries' capability to generate technological knowledge and the ability to use knowledge generated elsewhere (Fagerberg, 1994; Verspagen, 1997; Lee, 2013a). R&D-based generation of technologies matters most for developed countries while developing countries mostly rely on technologies produced in developed countries (Coe and Helpman, 1993). In Howitt and Mayer-Foulke's (2002) model, countries without their own R&D and lagging in technology can grow at a positive rate similar to frontier countries if they have the required absorptive capacity. In the absence of technology transfer from advanced countries to less-developed ones, the productivity and income gaps between them would increase further (Keller, 2000; Griffith *et al.*, 2003).

International trade plays the leading role in facilitating technology transfer (Keller, 2004). Grossman and Helpman (1991) discussed four channels through which diffusion of technologies occurs. First, they can diffuse following cross-country movement of intermediate inputs and capital equipment. Second, trade-related cross-border communications can facilitate learning of production processes, product design, and organizational innovation. Contracting and imitation of foreign technologies constitute the remaining two channels. Keller (2002) also noted two basic mechanisms of technology diffusion that follow international economic activities. The first involves direct learning of foreign technologies in which firms from less-developed countries access a blueprint or a design developed by firms in advanced countries. The second relates to using specialized and advanced intermediate products invented in developed countries. For less-developed countries lagging behind the global technology frontier, the latter channel plays the most important role if supplemented by all the corresponding important information (Coe *et al.*, 1997). However, not all countries and firms equally exploit these alternative channels. Absorptive capacities at both micro and macro levels play important roles.

Particular to latecomers, Siyanbola *et al.*(2012) noted that successful technological learning and innovation are crucial for better organizational performance. Learning is the most dynamic of human capabilities (Lundvall, 2011) crucial for innovation and productivity of an organization (Damijan and Kostevc, 2015). Organizations with better absorptive capacity are more successful in learning external knowledge and building innovation capabilities. Heterogeneity in inter-firm productivity arises from the underlying differences in learning and innovation capabilities (Mairesse and Mohnen, 2002; Mairesse *et al.*, 2005). Lee (2013b) indicated that technological cycle time and explicitness of knowledge also determine learning possibilities. Short cycle time and more explicit technologies are easier to learn. Therefore, the extent to which firms in less developed countries learn from international trade-induced technology transfer is an important topic. The following subsection provides a brief review of empirical evidences and drives hypotheses.

5.2.2. EMPIRICAL EVIDENCE AND HYPOTHESES

Many empirical works have been conducted on how international trade affects firm-level performance and innovation. However, results are mixed depending on the methodologies used and different conditions at the country, industry, and firm levels. Differences in methodology include using different measures of firm performance, such as profit, growth, value added, labor productivity, innovation, and total factor productivity (TFP). For instance, Kugler and Verhoogen (2009) indicated that using imported intermediate goods significantly raised the gross output of Columbian plants. However, they did not find such effect by using TFP as a measure of performance and controlling for plant effects. Findings depend also on whether a researcher investigates the impacts of import or export in isolation or includes the role of two-way trade. Recent studies (for instance, Kugler and Verhoogen, 2009; Foster-McGregor and Isaksson, 2014) show the merit of analyzing the roles of importing, exporting, and two-way trade together as a more complete form of learning through trade. As it will be seen in the following section, literature discusses the impact of variables at different levels in determining the extent to which a country benefits from trade. Among the important country-level conditions that affect the role of trade are openness to trade, institutional setup, and absorptive capacity. At industry level, market structure and the type and nature of technologies are among the major factors. At firm level, firm size, linkages, ownership, quality of human resource, and participation in international trade are among the major factors. Review of these literatures will follow.

5.2.2.1 Imported inputs, capital goods, and performance of firms

Literature on the relationship between importing and firm-level performance constitute those discussing the impact of all types of imported goods including final products and those focusing only on import of intermediate and capital goods. In this section, more focus is given to the latter type of literatures due to the fact that we are interested in the manufacturing firms' performance. Some evidence exists on the positive impact of import on performances of firms in both developed and developing countries. Among this evidence, there are studies by Halpern *et al.* (2011) for Hungary; Goldberg *et al.* (2009) and Hasan (2001) for India; Lööf and Anderson (2008) for Sweden; Yu and Li (2014) for China; Aristei *et al.* (2012) for a group of 27 Eastern European and Central Asian countries; and Kasahara and Rodrigue (2008) for Chile. Halpern *et al.* (2011) found that importing increases firm productivity by 12% out of which about 40% was generated as a result of substitution between foreign and domestic inputs. Using data spanning in 1975–1987, Hasan (2001) showed that imported inputs and investment in domestically produced capital goods have significantly raised firm productivity in India. In addition to confirming the positive productivity effect of importing, Lööf and Anderson (2008) noted that imports from developed countries have stronger effect compared to those from underdeveloped countries. Using data in 2002–2006, Yu and Li (2014) found that imported intermediate inputs raise firm productivity in Chinese manufacturing. Similarly, Aristei *et al.* (2012) showed positive impacts of imported inputs on both productivity and product innovation.

However, Conti *et al.* (2013) found that importing has no any impact on TFP of firms in Italian manufacturing. Instead, they proved “self-selection” of more productive firms to importing inputs than less productive ones. Similarly, Kugler and Verhoogen (2008, 2009) showed that more productive plants select into importing inputs from foreign markets where they get access to more varieties and buy higher-quality inputs at higher price. Kugler and Verhoogen (2008), particularly, investigated the quality-complementarity hypothesis (the hypothesis that input quality and plant productivity are complementary in producing quality output). They argued that the hypothesis carries an important implication regarding the role of trade in shaping industrial evolution in developing countries. In fact, the benefits earned by importing technology would vary with the type and nature of the technologies or industries. The benefits are higher in industries where technological opportunities and technology investments are highly prevalent (Hasan, 2001), in sectors where technologies are more explicit and easily embodied (Jung and Lee, 2010), in more concentrated sectors (Jacob and Meister, 2005), and where firms produce less complex products (Yu and Li, 2014).

In view of the infancy of the Ethiopian manufacturing, the above literature suggests that using imported inputs increases the opportunity for firms in learning foreign technologies. Firms in the Ethiopian manufacturing mainly belong to food processing, textile, garment, and leather and leather products. In these sectors, technologies are more traditional and explicit, and products are less complex. Therefore, the potential of learning new technologies is higher, particularly, for firms in the medium and large manufacturing sector where almost every firm relies on imported inputs but with different use intensities as data in the current study indicates. Kasahara and Rodrigue (2008) showed that the bottom 10 percentile firms in the share of imported inputs did not benefit at all, while the 90 percentile importers gained 20.1% productivity. Based on this literature, it is expected that

H1: The higher the proportion of imported inputs used by a firm, the greater is its productivity

The reasons for high productivity effect of using imported inputs are related to improved access to frontier technologies, quality of inputs, and firms' widened opportunities to specialize on activities of their best capability (Wagner, 2012). These reasons can equally apply for firms that invest in new capital goods. However, investment in fixed capital could be counterproductive if there is over investment in demand-constrained conditions. For instance, Lee *et al.* (2010) found that the performance of Korean Chaebols was strongly smashed in 1991 owing to over investment. Nevertheless, it is more logical to expect a positive relationship between investment in capital goods and productivity either due to the fact that only more productive firms would afford to invest or new capital goods would raise productivity driven by technologies embodied in the goods (Hasan, 2001; Augier *et al.*, 2013). In Ethiopia's manufacturing sector, investment in new capital goods is the main way of introducing modern technologies. Based on this ground, we hypothesize that

H2: Firms with higher investment in new fixed capital are more productive than firms with less or no investment in new capital

In relation to both *H1* and *H2*, it should be noted that using better quality inputs or new capital goods is not a panacea. Here, input refers to raw materials while fixed capitals include machines and related equipment used in the production process. Capital goods are mostly goods that are imported from firms either directly or indirectly. Manufacturing firms either buy from other importers or directly import the goods by their own. Firm-specific capabilities and market conditions determine the extent to which these goods improve performance. For example, Yasar (2013) and Augier*et al.* (2013) demonstrated that benefits from importing capital goods such as machineries and equipment depend on the quality of human capital of a firm.

In the Ethiopian context, the policy-induced effort to upgrade the capacity of fixed capital toward promoting better value addition on manufactured export (World Bank, 2015a) implies potential correlations between exporting and investment in fixed capital. Based on this, we expected that the productivity effects of both imported inputs and capital goods are higher for exporters than non-exporters due to the fact that exporters tend to have better production capabilities. Therefore, we proposed the following auxiliary hypotheses.

H1a: The productivity effect of imported inputs is higher for exporters than non-exporters

H2a: The productivity effect of new capital is higher for exporters than non-exporters

5.2.2.2 Export and productivity

Export promotion is one of the key policy aspects in any country. Larger engagement in export is assumed to improve productivity at both country and firm levels. However, there are controversies about whether it is productivity or exporting that comes first. The seminal paper of Bernard and Jensen (1999) showed that exporting firms are better in all characteristics ex-ante. They found strong evidence of self-selection indicating that growth in productivity and product innovation precedes exporting. They also confirmed that exporting increases market opportunity and plant size rather than productivity. Melitz (2003) developed an analytical model that demonstrates how exporting firms exhibit higher productivity than non-exporting firms prior to exporting and how exporting increases aggregate productivity through inducing reallocation of resources from less productive to more productive entities. The major channels through which firms benefit from exporting include competitive pressure, technological or knowledge spillovers, supplier-customer relation with foreign firms, widened market, scale economies, and policy incentives (Bernard and Jensen, 1999; Wagner, 2002).

Empirical works on the firm-level export-productivity nexus established diverse conclusions. Some concluded that exporting raises productivity of firms whereas some others proved self-selection (Wagner, 2007). Among others, Crespi *et al.* (2008) in the UK; Wagner (2002) and Powell and Wagner (2014) in Germany; Conti *et al.* (2013) in Italy; Mengistae and Pattillo (2004), Van Beisbroeck (2007), and Bigsten and Söderbom (2010) in selected African countries; and Srithanpong (2014) in Thailand found evidence in favor of learning-by-exporting. Some of the works in support of self-selection include Greenawayand Kneller (2004) in the UK; Fabling and Sanderso (2012) in New Zealand; and Bbaale (2011) in Uganda. Level of economic development in both exporting and export destination countries would explain parts of the observed differences in the findings. For instance, Wagner (2012) found that firms that export to highly developed countries have better opportunities to compete with or supply to technologically frontier firms that employ best capital goods and management practices. Therefore, exporting to a developed country involves higher benefits than exporting to less-developed destinations. In terms of exporting country of origin, the impact of exporting on productivity was higher for firms originating from developing countries (Martins and Yang, 2009) perhaps in relation to reasons explained in catch-up literature in terms of the importance of technological backwardness (Lee, 2013a).

Kugler and Verhoogen (2008) argued that firms from developing countries strive to upgrade product qualities and processes to meet the quality requirements of export markets and compete with the growing number of exporters. To this end, firms would use more high quality imported inputs to improve product quality and production processes. Export promotion policies such as reduced import tariff can also facilitate productivity by improving exporters' access to high-quality imported inputs (Kugler and Verhoogen, 2008, 2009). In particular, export-oriented firms in Ethiopia are the prime beneficiaries of incentives in terms of access to resources and low import tariff in addition to other potential benefits African firms would generally enjoy from exporting in relation to economies of scale (Van Beisbroeck, 2005) following improved market opportunity. This evidence suggests that exporting firms in Ethiopia are likely to perform better than non-exporting ones. Therefore, we can hypothesize that

H3: Exporting firms are more productive than non-exporting firms

It is important to note that productivity could also arise from export-induced import (Kugler and Verhoogen, 2009) or import-induced export (Aristei *et al.*, 2012) implying the joint importance of *H1* and *H3*. Among studies that found positive productivity premium for both importing and exporting firms, Vogel and Wagner (2009) in Germany; Foster-McGregor and Isaksson (2014) in Africa; Andersson *et al.* (2008) in Sweden; and Kasahara and Lapham (2012) in Chile are worth mentioning. This evidence also revealed that the productivity premiums are higher for firms engaged in both import and export due to increased international division of labor and employing high quality inputs. Therefore, testing *H3, H1a* and *H2a* separately while controlling for the potential effects of other key variables would give a better picture on trade induced learning.

5.3. DATA AND METHODOLOGY

5.3.1. DATA SOURCE

Data from the annual census of medium and large manufacturing firms in 2000–2011 were used to test the above hypotheses. It was gathered by the Ethiopian Central Statistical Agency (CSA) including all firms with 10 and above permanent employees. These data are appropriate for the current study as they include most of the important variables used to measure the dynamic performance of firms. The main caveat of the data is that it lacks variables that measure R&D efforts or innovation. The data for the main empirical analysis did not include all firms in the original dataset as a result of dropping observations with doubtful figures and missing values on the major variables during data clearing. Besides, only firms with two and more observations were included in relation to the modelling requirement of the main econometric model. Secondary data from the World Development Indicator were also used for the purpose of deflating monetary values of some variables.

The data includes both private and public-owned firms operating in 14 two-digit classified industrial sectors. These include manufacturing of foods and beverages, textile, wearing apparel, leather and leather products, wood products, paper products, chemicals, rubber and plastic, other non-metallic minerals, basic iron and steel, fabricated metal, machinery and equipment, motor vehicles and trailers, and furniture. More than 50% of firms in all years depend on imported inputs. The intensity of their dependence on imported inputs varies from sector to sector and from firm to firm. In terms of export, only 3.5–7% of firms had participated in export marketsin the data period. This information qualifies the importance of importing and exporting, which will be discussed in the empirical findings.

5.3.2. THE EMPIRICAL MODELS

This section presents strategies followed to estimate the productivity effects of exporting and embodied technology transfer. Productivity was measured in terms of labor productivity (*LabP*), total factor productivity (*TFP*), and TFP catch-up ($catch_{TFP}$). The empirical modeling follows research that was interested in identifying factors that determine firm-level productivity as reviewed in Nelson (1981). From the perspective of evolutionary theory, heterogeneities in the degrees of innovativeness and production efficiencies are attributed to the varying distributions of capital equipment of different vintages, idiosyncratic capabilities (or lack of them), mistaken-ridden learning, and path-dependent adaptation (Dosi and Nelson, 2010) which are assumed to be affected by international trade. Literatures also emphasize the role of in-house R&D effort as one of the major determinants of firm productivity. However, the absence of R&D variable in the current dataset limited the scope of this study only on R&D products developed elsewhere.

Therefore, this study concentrates only on the extent to which Ethiopian manufacturing firms learn through exporting and technologies embodied in imported inputs and capital. To this end, analyses were made based on estimating models of the form

$$P_{it} = \gamma_0 + \gamma_1 P_{it-1} + \gamma_2 export_{it} + \gamma_3 NKINV_{it} + \gamma_4 MRMint_{it} + \gamma_5 lnage_{it} + \gamma_6 size_{it} + \gamma_7 private_{it} + \gamma_8 CI_{jt} + \gamma_9 Foreign_{it} + \gamma_{10} D_{ij} + \mu_i + \varphi_{it} \qquad 5.1$$

where *P* represents any of the productivity measures in natural logarithm (ln*LabP*, *lnTFP or* $catch_{TFP}$) used as a dependent variable; *export* is dummy for exporting; *NKINV* is the ratio of new capital to total fixed capital; *MRMint* is the proportion of imported inputs; *lnage* is the natural logarithm of firm age; *size* is the natural logarithm of firm size; *private* is dummy for private ownership; *CI* is concentration index; *Foreign* is dummy for foreign ownership; γ are coefficients; *D* is vector of year and sector dummies; μ_i is firm-specific effect; and φ_{it} is a random disturbance term assumed to be distributed identically and independently across firms. The subscripts *i, j,* and *t* stand for firm, sector, and year respectively. Definitions of variables are given in the Appendix (Table A5-1).

Measuring productivity using labor productivity may not reflect actual differences in firm performances. The fact that firms may face different factor prices and apply other excluded inputs at different intensities, their labor productivities may differ even upon using similar production technologies. For this reason, using TFP is preferred as it does not vary with the intensity of use of observable factor inputs and their relative costs. However, the problem lies with the difficulty of estimating TFP. Conceptually, TFP is the variation in output that cannot be explained by observable inputs; rather it is a residual or the unexplained part of a production function. If we specify a production function of Hicks-Neutral technology and a Cobb-Douglass form as

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m} \qquad 5.2$$

where Y_{it} represents output of firm i in period t ; $K_{it,}$ $L_{it,}$ and M_{it} are inputs of capital, labor, and materials respectively. A_{it} is the TFP or the efficiency level of firm i in period t. Different TFP estimation methods have been developed, which can broadly be classified into non-parametric, semi-parametric, and fully parametric methods. Each method has its own merits and limitations as reviewed by Van Biesebroeck (2007).Semi and fully parametric methods often begin estimation by logarithmic transformation of equation (5.2) to get a linear function of the form

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it} \qquad 5.3$$

where small letters represent logarithm of the variables in equation (5.2) and ε_{it} denotes disturbance term.

Estimating equation (5.3) using ordinary least square OLS causes omitted variables bias due to correlations between firms' choice of inputs and unobserved firm-specific productivity shocks (Van Beveren, 2010). Provided that productivity is time-invariant, adding firm fixed effects into the estimation could solve the problem. However, this strategy is inappropriate if interest is on firm-level productivity change. Among the alternative estimation strategies developed in literatures, Levinsohn and Petrin (2003) method is well known to solve the problems and hence applied in this paper. The method considers two components of the error term in equation (5.3) leading to

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it} \qquad 5.4$$

where the first component of the error term (ω_t) is the transmitted productivity component: a state variable that affects a firm’s choices of inputs. The second component (η_t) is uncorrelated with input choices. Thus, ignoring the correlations between inputs and the first component leads to inconsistency in estimating production function due to simultaneity problem. Assuming a Cobb-Douglas production function, Levinsohn and Petrin (2003) used firms' raw material inputs to correct for simultaneity in estimating production function.

Therefore, when TFP was used to measure performance, estimation of equation (5.1) had to follow two steps where TFP was estimated in the first step using the above approach. Estimating (5.1) on TFP catch-up is the extension of the two-step process up on computing TFP catch-up borrowing the concept from Jung and Lee (2010). In all the three versions of the equation, we analyzed the effects of exporting, importing, and investment simultaneously. Excluding any of these variables may result in an upward bias on productivity even when there is a simple spurious correlation (Kasahara and Rodrigue, 2008; Conti *et al.,* 2013). To test the potential associations between these variables (*H1a* and *H2a*), another TFP equation is estimated by adding the interaction of *export* dummy with *MRMint* (*Exp*imp*) and with *NKINV* (*Exp*inv*).

Equation (5.1) can be estimated using the traditional OLS and fixed effect methods. However, these methods suffer from dynamic panel bias due to correlation of lagged values of the dependent variables with the fixed effect in the error term (Roodman, 2009). The RHS variables may fail to satisfy strict exogeneity assumption required for consistency of estimators. Time-invariant firm characteristics (fixed effects) such as managerial skills may be correlated with the explanatory variables leading to an endogeneity problem. Least square dummy variable (LSDV) and instrumental variable (IV) approaches would solve the problem. However, LSDV works only for balanced panel and does not address the potential endogeneity of other regressors while the IV method involves the challenge of finding an appropriate instrument.

Arellano and Bond (1991) developed a generalized method of moment (GMM) technique that eliminates bias by transforming variables. Later, Blundell and Bond (1998) improved the estimation method noting that the validity of instruments from first differencing transformation may suffer in cases where input and output variables are persistent. They developed a system GMM that uses more moment conditions from lagged first difference of the dependent and independent variables. In this paper, we applied a one-step system GMM with heteroscedasticity consistent standard errors and using forward orthogonal deviations to transform the equations as this reduces data losses when the panel data are unbalanced (Roodman, 2009). After the system GMM estimation, the Arellano and Bond tests of autocorrelation and the Hansen test for joint validity of the instruments were used as standard after GMM.

Variables *lnage, size, private, Foreign, CI,* and dummies for year and sector were included to control heterogeneities among firms. Year and sector dummies were added to capture macro productivity shocks and sectoral effects, respectively. Positive significant coefficients of *export, NKINV,* and *MRMint* suggest evidence of "learning-by-exporting,""learning-by-investment," and "learning-by-importing," respectively. However, due to the potential problem of firms' self-selection into exporting, investment, and importing, it is important to validate regression results using methods that could disentangle selection effects from actual productivity effects. For this purpose, we applied models of treatment effect namely difference-in-difference (DID), matching technique, and a combination of the two. The first technique requires exploiting the panel nature of the data unlike the matching technique, which can best fit for cross-sectional data. The detailed estimation strategies and discussions on these alternative techniques were withheld for the sake of brevity but are available on request from the authors.

5.4. RESULTS AND DISCUSSION

This section discusses results of the empirical analyses corresponding to the three measures of performance namely, labor productivity (LabP), total factor productivity (TFP), and TFP catch-up. LabP and TFP catch-up were estimated using a simple formula while TFP was estimated using a semi-parametric method of Levinsohn and Petrin (2003). Arnold (2005) indicated that when TFP is estimated using this method, there should be enough variations in the data for separate identification of all input coefficients and the coefficient of intermediate input should be different from one to satisfy consistency of the measure. These conditions have been satisfied in the estimation process. Moreover, the estimated TFP appeared to have a high correlation (0.817) with LabP. Therefore, results of the main estimating equations can be used for inference.

Table 5.1 presents the summary statistics of the main variables. It shows that the mean TFP and LabP of firms are about 6.7 and 10 log points, respectively, while that of $catch_{TFP}$ is -2. The maximum TFP and LabP are 13 and 17, respectively. The mean proportion of new capital in total firms' capital asset is about 0.1, while that of imported raw material is 0.352. The mean values of market concentration, age, and size of firms are 0.48, 2.36, and 3.45, respectively.

Variable	Obs	Mean	Std. Dev.	Min	Max
lnTFP	11211	6.694	1.015	-0.780	13.335
LnLabP	11211	10.257	1.521	2.220	16.779
$catch_{TFP}$	11211	-2.057	1.467	-12.362	0.000
export	11211	0.051	0.220	0.000	1.000
NKINV	10814	0.092	0.180	0.000	1.000
MRMint	11211	0.352	0.398	0.000	1.000
CI	11211	0.482	0.179	0.246	1.000
lnage	11211	2.361	1.067	0.000	4.605
size	11211	3.432	1.332	0.693	8.402
Foreign	10003	0.042	0.201	0.000	1.000
private	11211	0.911	0.285	0.000	1.000

Table 5.1 Summary statistics

Table 5.2 displays all regression results under eight columns with robust standard errors. Columns (1)–(3) display results of *lnLabP,* while columns (4)–(6) are results of TFP equations estimated using SYSGMM, POLS, and RE, respectively. In both *lnLabP* and *lnTFP*, estimates from the three methods are similar in their sign but slightly different in significance levels as expected. Column (7) shows SYSGMM estimation of TFP but excluding the variable *"Foreign"* considering its statistical insignificance in columns (4)–(6). Interestingly, the coefficients of other variables in column (7) did not show any significant difference from those in column (4) despite changes in the number of observations. The last column (8) presents the results of SYSGMM on TFP catch-up ($\text{catch}_{\text{TFP}}$).

The first row of Table 5.2 contains one year lagged values of the dependent variables (*lnLabP*, *lnTFP* and $catch_{TFP}$). The positive and strongly significant coefficients of $lnLabP_{it-1}$ and $lnTFP_{it-1}$indicate the persistence of productivity. The coefficient of *lage* appeared to be strongly significant in determining the *TFP* and *TFP* catch-up of firms (columns 4–8), which indicates that a 10% increase in age (or experience) of a firm leads to about 5% and 6% increases in TFP and $catch_{TFP}$, respectively. This can be taken as evidence in favor of the "learning-by-doing" hypothesis of Arrow (1962).

	lnLabP			**lnTFP**				**catch$_{TFP}$**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$lnLabP_{t-1}$/	0.280***	0.561***	0.319***					
$lnTFP_{t-1}$/	(0.048)	(0.014)	(0.017)	0.085*	0.348***	0.209***	0.095**	-0.056*
$catch_{TFPt-1}$				(0.044)	(0.017)	(0.018)	(0.045)	(0.029)
lnage	0.037	0.005	0.044**	0.047***	0.026**	0.036***	0.054***	0.060***
	(0.024)	(0.015)	(0.021)	(0.017)	(0.011)	(0.014)	(0.016)	(0.018)
size	-0.153***	-0.079***	-0.229***	0.111***	0.098***	0.087***	0.111***	0.247***
	(0.053)	(0.014)	(0.023)	(0.034)	(0.011)	(0.016)	(0.034)	(0.032)
private	-0.397***	-0.227***	-0.344***	-0.180**	-0.100***	-0.171***	-0.168**	0.061
	(0.097)	(0.045)	(0.075)	(0.077)	(0.034)	(0.054)	(0.074)	(0.088)
Foreign	0.163**	0.150**	0.152*	0.057	0.057	0.058		-0.015
	(0.080)	(0.064)	(0.078)	(0.061)	(0.048)	(0.060)		(0.148)
MRMint	0.633***	0.278***	0.248***	0.258*	0.084**	0.049	0.254*	0.241**
	(0.202)	(0.043)	(0.054)	(0.149)	(0.034)	(0.043)	(0.149)	(0.121)
$NKINV_{t-1}$	0.044*	0.023**	0.016*	0.039**	0.011	0.008	0.038**	0.036**
	(0.025)	(0.010)	(0.009)	(0.017)	(0.007)	(0.007)	(0.017)	(0.016)
export	0.845***	0.557***	0.640***	0.452***	0.284***	0.322***	0.461***	0.356***
	(0.170)	(0.056)	(0.076)	(0.133)	(0.043)	(0.059)	(0.132)	(0.127)
CI	1.445***	0.686**	0.902***	1.931***	1.029***	1.115***	1.703***	0.923**
	(0.529)	(0.325)	(0.325)	(0.449)	(0.286)	(0.298)	(0.427)	(0.455)
_cons	8.371***	5.319***	8.343***	5.780***	4.425***	5.303***	5.241***	-3.515***
	(0.554)	(0.190)	(0.244)	(0.311)	(0.141)	(0.159)	(0.355)	(0.254)
Year & sector dummies included								
No. of obs.	7563	7563	7563	7563	7563	7563	8080	7563
No of firms	2122	2122	2122	2122	2122	2122	2177	2122
No. of inst	680			824			825	1149
AR(1)	0.000			0.000			0.000	0.000
AR(2)	0.923			0.962			0.815	0.126
Hansen test	0.292			0.509			0.357	0.259

*, **, *** show significant at 10, 5, and 1% levels, respectively. Robust Standard Errors in parentheses.

Table 5.2 Regression results

With respect to firm size, results from labor productivity and TFP show striking differences. The negative and strongly significant effect of size on labor productivity indicates that the smaller the size of a firm, the higher is its labor productivity. The simple reason for this relationship underlies the fact that the number of permanent employees was used to measure both firm *size* and labor productivity in such a way that inverse relationship occurs between the two. Moreover, it is not uncommon that firms with higher labor productivity would employ less number of workers than low productivity firms. On the other hand, firm size revealed strong positive effects on both TFP and TFP catch-up indicating higher productivity of larger firms than smaller ones.

The coefficients of *"private"* dummies turned negative and strongly significant in all columns, except column (8), implying better performance of public-owned firms than their private counterparts. The positive coefficient of "*Foreign*" dummy on both *lnLabP* (significant) and *lnTFP* (insignificant) shows that foreign firms are more productive than domestic firms. This is expected, as foreign firms are often equipped with more qualified workers, better management practices and technologies. The coefficients of concentration (CI) in all the columns of Table 5.2 show strong positive significance (below 1% level), implying greater performance of firms in more concentrated sectors than firms in less concentrated sectors. Corresponding to its effect on *lnTFP* (1.931), a 10% rise in concentration leads to a 19% increase in TFP, keeping other variables constant.

5.4.1.1 Imported inputs, new capital goods, and performance

The first hypothesis (*H1*) proposed a positive productivity effect of using more imported inputs (*MRMint*). This was supported by all regression results with varying significance levels. The coefficient of *MRMint* in labor productivity regression is higher both in terms of statistical (at less than 1% level) and economic significances (0.633) than that of TFP and TFP catch-up. Given the effect of other variables, if a firm makes a 10% increase in the proportion of imported inputs, its labor productivity would increase by 6.3%, which is far greater compared to the gains in TFP (2.6%) and TFP catch-up (2.4%). The higher impact of imported inputs on labor productivity would mainly reflect the skill upgrading effect of using imported inputs (Crinò, 2011).Similarly, the positive significance (5%) of import on TFP catch-up supports Jung and Lee (2010) who stressed the crucial role of importing embodied technology for TFP catch-up of firms in latecomers. Reducing import tariff in Ethiopia was shown to benefit input importers (Bigsten *et al.*, 2013) perhaps due to improved access to high quality inputs. A case study by Sonobe *et al.* (2007) on the Ethiopian shoe clusters revealed that soles imported from Europe helped manufacturers produce high quality and new fashion shoes because of access to better designs embodied in soles and adoption of technologies from suppliers.

The second hypothesis (*H2*) implicitly assumed that productivity increases due to investment in new capital goods *(NKINV),* which embody technologies developed through R&D efforts in advanced countries. After taking a one year lagged value of new capital investment (*NKINV)*, the coefficients of *NKINV* turned positive and significant confirming the hypothesis in all the three alternative measures. The coefficients indicate that if a firm increases the proportion of new capital goods by 100%, the firm would improve its performance by about 4%, ceteris-paribus. In view of increasing competition in international market and technological advancement, investment in new capital goods implies access to “state of the art” technologies. Therefore, the increment in labor productivity, TFP, and TFP catch-up of firms following investment in new capital goods can be associated with technologies embodied in the goods and the resulting improvement in the innovation capabilities of the firms.

5.4.1.2 Exporting, importing, new capital goods, and performance

On the presumption that importing and investment in new capital are related to export, two auxiliary hypotheses (*H1a* and *H2a*) were proposed. Before proceeding to the estimation results, let us see a quick description of potential differences between exporters and non-exporters in terms of capital and imported input intensities using mean comparison tests (Table A5-3). Results of the tests demonstrated that the proportion of imported inputs in total raw materials is significantly lower for exporters than non-exporters. However, when computed relative to employment, exporters appeared to use higher imported inputs. Both capital intensity (K/L) and proportion of new capital goods were higher for exporters than non-exporters. Similarly, regression results in columns (1) and (2) of Table 5.3 display differences in the coefficients of imported inputs (*MRMint*) and new capital goods (*NKINV*) when estimated with and without *export*.

lnTFP	(1)	(2)	(3)	(4)
lnTFP_{t-1}	0.126*** (0.041)	0.129*** (0.045)	0.127*** (0.046)	0.135*** (0.044)
lnage	0.051*** (0.016)	0.049*** (0.016)	0.043*** (0.016)	0.045*** (0.016)
size	0.112*** (0.035)	0.127*** (0.035)	0.147*** (0.035)	0.137*** (0.033)
Private	-0.128 (0.081)	-0.164* (0.086)	-0.139* (0.078)	-0.142* (0.083)
CI	1.573*** (0.422)	1.522*** (0.429)	1.642*** (0.424)	1.490*** (0.425)
export	0.425*** (0.132)			
MRMint	0.272** (0.142)	0.241* (0.147)	0.156 (0.156)	0.197 (0.141)
NKINV_{t-1}	0.039*** (0.014)	0.030** (0.013)	0.040** (0.018)	0.019* (0.011)
Exp*imp			0.466* (0.258)	
Exp*inv				0.142 (0.096)
_cons	5.032*** (0.345)	5.050*** (0.372)	4.936*** (0.362)	4.981*** (0.360)
Year & sector dummies included				
No. of obs.	8080	8080	8080	8080
No. of firms	2177	2177	2177	2177
No. of inst	885	784	761	860
AR(1)	0.000	0.000	0.000	0.000
AR(2)	0.684	0.571	0.574	0.580
Hansen test	0.782	0.246	0.115	0.641

Table 5.3 Results of SYSGMM on lnTFP (H1a and H2a)

*, **, *** show significant at 10, 5, and 1% levels, respectively. Robust Standard Errors in parentheses.

Direct tests of *H1a* and *H2a* correspond to results reported in columns (3) and (4) of Table 5.3. The coefficient of the Exp*imp (0.466) shows that the productivity premium from using imported inputs by exporters exceeds that of non-exporters by 46.6% confirming *H1a*. Compared to the coefficients of *MRMint* in columns (2) and (3), the effect of importing on the productivity of exporters is more than double of the effect on non-exporters. This can partly be caused by exporters' tendency to utilize a greater proportion of imported inputs than non-exporters. However, the mean comparison test indicates that the intensity of using imported inputs was significantly higher among non-exporters than exporters. This is evident also from the negative pair-wise correlation (Table A5-2) between *MRMint* and *export.* On the other hand, exporters seem to have higher import to employment ratio than non-exporters. Therefore, the greater impact of importing on the TFP of exporters is not related to the quantity, rather the higher capability of exporters in matching raw materials with labor.

Similarly, the coefficient of the *Exp*inv* (0.142) (column 4 of table 5.3), shows that exporters generated 14.2% more productivity than non-exporters from investment in new capital goods. Despite the statistical insignificance of the coefficient, the economic impact appears to be far larger when compared to the coefficients of *NKINV* in columns (2) and (4). This could arise for different reasons. The first reason could be due to the fact that exporters would tend to invest more on new capital goods (as shown in Table A5-3) than non-exporters. Therefore, a higher productivity premium from using new capital goods among exporters would partly emanate from higher quantity or quality of the goods with embodied technologies. Generally, results suggested the validity of the two auxiliary hypotheses (*H1a* and *H2a*) that embodied technology transfer is higher among exporters than non-exporters.

5.4.1.3 Exporting and firm performance

The third hypothesis (*H3*) is about the impact of export on the productivity and productivity catch-up of firms. Results in Table 5.2 display strong positive significance (less than 1% level) of the coefficients of *export* dummies in all cases but with greater magnitude on labor productivity (column 1) than on TFP (column 4) and TFP catch-up (column 8). The positive and strong significance of exports indicates that export orientation improves firm performance in terms of all the three measures. Specifically, the results showed that exporters have 132%, 57%, and 43% premiums[10] over non-exporters in terms of labor productivity, TFP, and TFP catch-up, respectively.

[10]computed as *100(exp(coefficient)-1)%*

Among similar studies in Ethiopia, the finding is in line with that of Bigsten and Gebreeyesus (2009). However, the current study pushed further than the 2009 study to drive implications on sectoral productivity as indicated in Melitz's (2003) model by analyzing the role of export on TFP catch-up. Accordingly, the current study shows that exporters enjoy a significantly higher TFP catch-up than non-exporters. This implies improvement in the competitiveness of exporters with reference to a frontier firm in their respective two-digit sectors. This can increase sectoral productivity due to improved competition, which can ultimately contribute to the country's aspired structural change.

5.4.2. RESULTS FROM MATCHING TECHNIQUES

Findings from the above regressions support all the hypotheses. Despite the fact that system GMM (SYSGMM) corrects for endogeneity, results with respect to imported inputs, investment in new capital, and exporting may not preclude the effect of self-selection of more productive firms into exporting, importing, and investing. With respect to exporting, Wagner (2007) reviewed alternative ways of dealing with the problem where he also noted the fact that most studies confirmed self-selection of more productive firms into export markets while exporting does not necessarily improve productivity.

Taking this into account, we checked the robustness of regression results using alternative approaches, namely propensity score matching (PSM), difference-in-difference (DID),and a combination of the two (PSM-DID). PSM is a useful tool if there is no baseline data and it constructs a statistical comparison group based on a model of the probability of participating in the treatment conditional on observed characteristics or the propensity score. DID estimator relies on a comparison of treatment and control groups before and after a firm engages in any of the above activities. This method purges the unobserved firm characteristics that would lead to selection bias through differencing. Combining DID and PSM would solve the potential shortcomings of the two methods provided that rich data on control and treatment areas exist (Khandker *et al.*, 2010).

In re-assessing the “learning-by-exporting” hypothesis, the treatment group is exporters while the control group constitutes non-exporters. In case of investment in new capital goods and use of imported inputs, we created dummies (denoted by DNKINV and DMRMint) from the continuous values of the two variables (assigning “1” if the values are greater than averages and '0' otherwise). Accordingly, the treatment area corresponding to importing inputs (investment in new capital) is high input importer (high investment in capital) while the control is low input importers (low investment in new capital).

In order to apply the PSM technique in all the three treatment effects, we generated cross-sectional data by averaging values of the outcome (productivity) and firm characteristics over the years. Then matching was performed following the nearest neighborhood technique with bootstrapped standard errors upon satisfying the balancing conditions (meaning that the distributions of the treated group and the comparator must be similar) and selecting the common support options. Table 5.4 presents brief results of the three alternative techniques.

Table5.4 shows that the average treatment effects on the treated (ATT) in labor productivity are significantly different for firms with high investment (DNKINV), high import (D*MRMint*), and exporters (*export).*Their respective productivity premiums are 24%, 33%, and 64 %. In terms of *TFP;* however, only high investment and *exporting* have positive productivity premiums estimated to be 21% and 27%, respectively. Similar to regressions, the PSM results, generally, suggested that greater investment in capital goods, using more imported inputs and exporting improve productivity.

		LabP				*TFP*	
Technique	*Variable*	*treated*	*Control*	*ATT*	*t-value*	*ATT (Effect)*	*t-value*
PSM	DNKINV	563	513	0.238	2.456**	0.211	2.733***
	DMRMint	846	323	0.325	3.421***	-0.033	-0.433
	export	183	119	0.644	3.756***	0.256	2.272**
DID	*export*	220	174			0.388	3.72***
PSM-DID	*export*	220	174			0.493	2.46**

Table 5.4 Results of matching techniques

,* show significant at 5 and 1% levels, respectively

Regarding the impact of exporting on TFP, DID, and the combination of DID and PSM were applied in addition to the PSM method. Results of DID and PSM-DID methods showed that the TFPs of exporters are higher than that of non-exporters by about 39% and 49%, respectively. These results appeared to be lower than that of regression but higher than the PSM result. Methodologically, the PSM-DID result is more robust. Details of the estimation strategies and results of the alternative techniques are not presented in this paper but available upon request.

5.5. CONCLUSION

This paper examined the role of imported inputs, new capital goods, and exporting on firm performance in the Ethiopian manufacturing sector. Using more imported inputs and new capital goods was expected to improve performance of firms due to technologies embodied in the goods. Exporting was also assumed to improve performance of firms. Unlike earlier studies, the paper examined the impacts of embodied technology transfer along with exporting taking into account their potential interactions. Performance was measured in terms of labor productivity

(LabP), total factor productivity (TFP), and TFP catch-up. Firm-level data from the Ethiopian large and medium manufacturing in 2000–2011 were utilized in the analyses. The data were analyzed using econometrics and matching techniques following a two-step estimation procedure.

Results from the econometric analyses indicate that imported inputs, investment in new capital goods, and exporting significantly increased LabP, TFP, and TFP catch-up of firms with different levels of significance. Statistically, the impact of imported inputs is stronger on LabP while that of new capital goods is higher on firms' TFP and TFP catch-up. Moreover, the positive effects of imported inputs and new capital goods on TFP turned out to be higher for exporting than non-exporting firms implying exporters' greater capability to learn from embodied technologies.

The matching techniques employed to probe the potential impacts of "self-selection" also validated the regression results with slight differences between LabP and TFP. In terms of LabP, high use of imported inputs, high investment in capital goods, and exporting appeared to have strong positive effects. In case of TFP, however, only new capital goods and exporting have shown positive productivity effects. A positive significant effect of imported inputs on TFP was brought out in the regressions, but not the matching procedure. This seems to reflect a "selection effect" rather than ex-post productivity effect. The finding implies that firms with higher TFP tend to consume more imported inputs probably due to their better access to the inputs. However, as far as imported inputs increased LabP, a similar effect on TFP would be inevitable, at least in the longrun considering the persistence of productivity in the econometric results. Persistent increase in LabP would ultimately lead to higher TFP.

The statistically stronger effect of new capital goods on TFP and TFP catch-up in both regression and matching results indicate that investment in capital goods involve greater potential in transferring embodied technologies than imported inputs. The strong positive and far greater impact of imported inputs on LabP (than TFP and $\text{catch}_{\text{TFP}}$) implies that increasing access to more imported inputs would substantially raise labor productivity. Cutting tariffs on imported inputs is one way toward improving access to the inputs as was also suggested by Bigsten *et al.* (2013). Considering the evidence that low labor productivity stood among the major constraints in Ethiopian manufacturing (World Bank, 2015a), any measure that can improve labor productivity is of strategic importance. Exploiting the country's potential in manufactured exports is also pivotal to economic transformation (World Bank, 2012). To this end, increasing access to imported inputs, helping firms upgrade their capital goods, facilitating linkages with foreign suppliers, and encouraging use of advanced technology to build the innovation capability of domestic firms are important as can be implied from the empirical results. Solving the problem of credit constraints, which was the second most important bottleneck of doing-business in Ethiopia (World Bank, 2015b), is crucial to improve the accessibility of foreign technologies. Coordinated and effective implementation of these measures can facilitate technology transfers aimed at building local innovation capabilities and accelerating structural transformation.

In general, this study provides a better view of technology transfer through international trade by dissecting the separate effects of importing, investing, and exporting. It contributes to both the empirical and theoretical literature and provides direction for firm managers and policymakers toward achieving better performance of firms and the manufacturing sector as a whole. The differential impacts of imported inputs and capital goods on the performance of exporters and non-exporters imply the potential for making better use of inputs by managers. From a policy perspective, facilitating easy access to high quality inputs, new capital goods, and implementing more pragmatic measures towards export promotion are crucial for the aspired economic transformation in Ethiopia. However, the study could not specify the type of fixed capitals and what internal capacities are crucial in building local innovation capabilities. Therefore, future research would consider using more detailed data and conducting case studies that would help identify key inputs and capitals with their respective implications on the competitiveness of firms in both domestic and foreign markets.

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APPENDIXES

Variable	Definition
TFP	Total factor productivity
LabP	Labor productivity computed as a firm's value added divided by the number of total permanent employees
$catch_{TFP}$	The difference between the TFP of a firm and the TFP of a frontier firm in a two-digit sector
age	Firm age measured as the number of years since a firm started operation
size	Firm size measured as the natural logarithm of the number of permanent full time employees
export	Dummy for exporting
MRMint	The proportion of imported raw materials to the total raw materials a firm used in each year
NKINV	The proportion of a firm’s investment in new capital to the yearend book value of capital
private	Dummy for private ownership (assigned “1” if the government's share in current total paid-up capital of a firm is below 50% and “0” otherwise)
Foreign	Dummy for foreign ownership (assigned value “1” if foreigners have stock in the current total paid-up capital of a firm and “0” otherwise)
CI	Concentration index computed as the sum of the market share of the first four largest firms in two digit industry (called large firm dominance in Jung and Lee, 2010)

Table A 5-1 Definition of variables

	lnage	size	CI	Foreign	private	MRMint	export	NKINV
lnage	1							
size	0.331	1						
CI	-0.081	-0.110	1					
Foreign	0.037	0.112	-0.012	1				
private	-0.318	-0.414	-0.011	0.046	1			
MRMint	0.037	0.1777	-0.043	0.106	0.021	1		
export	0.111	0.314	-0.044	0.064	-0.147	-0.058	1	
NKINV	0.010	0.048	-0.024	-0.008	-0.009	0.011	0.020	1

Table A 5-2 Pair-wise correlation

	Mean_MRMint	Mean_NKINV	ln(K/L)	ln(Import/L)
non-exporters	0.358	0.229	9.813	5.411
exporters	0.254	0.405	10.873	6.360
diff	0.104	-0.176	-1.061	-0.949
t-value	6.102	-2.154	-13.515	-15.500
Pr(T > t)	0.000	0.031	0.000	0.000

Table A 5-3 Mean-comparison test

CHAPTER 6. THE IMPACT OF FDI ON THE PRODUCTIVITY AND GROWTH OF ETHIOPIAN FIRMS

Abdi Yuya Ahmad

ABSTRACT

Using firm-level data from 2000 to 2011 on the Ethiopian large and medium enterprises, we examined the effect of foreign direct investment on the productivity and growth of domestic firms. In this paper, we argue that there is a positive horizontal spillover effect from foreign to local firms in terms of productivity and growth, and this effect is stronger for firms with high absorptive capacity. To verify this argument, we applied a two-step estimation strategy where we first computed total factor productivity and sales growth. In the second stage, we estimated productivity and growth regressions using the extended version of system generalized method of moments. The result shows that FDI has a positive significant effect on both total factor productivity and growth, taking more disaggregated sectoral classification as the best way of examining horizontal spillover. The spillover effect is stronger for firms with higher absorptive capacity or higher efficiency. This paper also shows a sign of negative competition effect on the growth of local firms upon using two-digit ISIC. The implication derived from the finding suggests the importance of raising the capacity of local firms to maximize benefits obtained from FDI, while pursuing selective strategy that encourages entry of foreign firms in strategic sector and in such a way that entry does not compromise the competitiveness of local firms.

Key words: firms, productivity, sales growth, FDI spillover, absorptive capacity

6.1. INTRODUCTION

For poor countries that invest less in innovation and R&D, the main source of building their capability towards technological and economic convergence is to rely on foreign technologies (Keller, 2001). Foreign technologies can transfer through domestic firms' engagement in international markets, import of intermediate goods, technology licensing, and foreign direct investment (FDI) (Lee, 2013). In less developed countries where firms lack the required competence to enter international markets and are financially constrained to import technologies, FDI is the feasible option for technology transfer. FDI can boost the productivity of host countries if the degree of technological spillover is large (Konings, 2001). Large technology spillover requires high existence of foreign firms, which are supposed to have better technology, management, and marketing skills.

Based on this theoretical ground, governments in developing countries offer various incentives to attract FDI expecting externalities beneficial to the domestic firms. Likewise, the Ethiopian government has incentive packages for FDI in its strategic sectors. Fueled by this and the prevalence of cheap labor in the country, compared to other sub–Saharan countries, there have been an increasing number of incoming foreign firms over the last two decades. Ethiopia is especially ranked the fourth largest recipient of Chinese FDI in Africa following Nigeria, South Africa, and Zambia, in their respective order (Shen, 2013). Despite all the theoretical expectations, empirical findings on the effect of FDI on the productivity of local firms have never been clear and consistent especially in developing countries.

Reviews of previous research on FDI spillover effect indicate less evidence of horizontal spillover effect and if there is, it is more likely to be negative (see e.g., Blomstrom and Kokko, 1998; Görg and Greenaway, 2004; Javorcik and Spatareanu, 2005; Crespo and Fontoura, 2007; Smeets, 2008; Iršova and Havrànek, 2013). Most of the researchers found robust evidence for vertical spillover rather than horizontal. The methodology applied, country conditions, the type of data, and the extent of disaggregation firms into different categories play a vital role for the diverging results. According to Damijan *et al.* (2013), some recent studies have come up with positive results on the possibility of horizontal spillover effect in transition economies yet remained only as a case study since they applied heterogeneous methodologies. Taking into account the heterogeneity of firms in all the possible ways helps elicit the real effects of FDI on domestic firms (Damijan *et al.*, 2013). Therefore, despite the fact that research on FDI spillover has been conducted since a long time, there is a continuing quest for the effect of FDI on host countries. In fact, most studies have been conducted in developed and emerging economies. Studies have rarely been undertaken in poor African countries.

So far, no study has been conducted explicitly on the FDI spillover in Ethiopia. The only exception, to our knowledge, is Seyoum *et al.* (2015), who examined Chinese investment in Ethiopia from an outward perspective. They found a positive productivity spillover from the Chinese to the Ethiopian firms. However, their finding casts doubt on the robustness of the results, primarily due to truncation of foreign firms considering only investment from China. Second, due to the fact that they used cross-sectional data, the findings would face similar critics on the early studies that used cross-sectional data. As reviewed by Görg and Strobl (2001) and Görg and Greenway (2004), almost all studies that used cross-sectional data found positive horizontal spillover while only few of the studies that used panel data found the result. Nevertheless, the study by Seyoum *et al.* (2015) turned out to be a complement to the current study in terms of the results despite all the differences in methodologies and data.

In this study, we go beyond examining only the effect of FDI on productivity, unlike previous studies, by extending the analysis in such a way that we can disentangle the effect of FDI on different firm-level performance indicators. Specifically, we have looked into the effect of FDI on productivity and growth of the local firms. We have also investigated if FDI variables computed at different levels of disaggregation vary in their effect. Firm heterogeneity in terms of size, absorptive capacity, productivity, and ownership is also taken into account.

The aim of this paper is to examine whether presence of foreign firms in a sector benefits domestic firms in terms of productivity and growth. We will also examine if there is a difference in FDI spillover due to differences in local firms' absorptive capacity. Therefore, the paper seeks answers to three major questions. Does high FDI in a sector helps domestic firms improve productivity? Do domestic firms in sectors with high FDI grow faster than firms in sector with low FDI? What role does Absorptive capacity plays in FDI spillover? To answer these questions we used firm-level data and applied the extended system generalize method of moment (SYSGMM) by Blundell and Bond (1998).

The paper contributes to the body of knowledge in three main ways. First, it adds to the only few studies that found the presence of horizontal spillover effect in general and rare studies conducted in sub–Saharan countries. Second, it is the first research that makes an attempt to study whether FDI spillover affects the productivity and growth of the host country's firms in a different manner. Third, unlike other works so far, it shows the varying effect of absorptive capacity and FDI on productivity and growth, respectively, of local firms when FDI is computed at two- and four-digit International Standard Industrial Classification (ISIC).

The rest of this paper is organized as follows. Section 6.3 presents the theoretical and empirical reviews of FDI spillover and hypotheses. Section 6.4 presents the methodology including the data and estimation strategies. Section 6.5 presents the results and discussions and Section 6.6 concludes based on the results.

6.2. LITERATURE REVIEW AND HYPOTHESES

FDI is seen as the vehicle of technology transfer from developed to less developed countries and a means of catching-up to the former through its spillover effect (Keller, 2001) and improving market competition (Görg *et al.*, 2009). Firms from developed countries have superior technology and invest more in productivity enhancing activities than firms in the host developing countries. Thus, high entry of foreign firms in a country would increase the availability of better technologies and investments (Girma *et al.*, 2014). This would help firms in host countries through horizontal (or intra-industry) and vertical (or inter-industry) spillovers, which are the two types of FDI spillovers that have been discussed in literatures. Despite the consensus that has long existed on the benefit of FDI for host country firms, only recently have the empirical literatures begun to identify differences between horizontal and vertical types of spillover (Damijan *et al.*, 2013).The former type happens when domestic firms benefit from the presence of foreign firms in the same sector, while the latter occurs when domestic firms are linked with foreign affiliates either in the upstream or downstream sectors. The effect of any of these types is reflected in improved productivity, or other benefits accrued to local owned firms (Buckley *et al.* 2007). However, empirical findings often confirm vertical spillover than horizontal spillovers (Blomström and Kokko, 1998; Görg and Greenaway, 2004; Crespo and Fontoura, 2007; Smeets, 2008).

With regard to horizontal spillover, results have been mixed owing to the methodology and heterogeneity of firms and the spillover effects in many ways. For instance, for positive externality to happen, proximity of domestic firms with multinational firms or their affiliate is important (Görg and Greenway, 2004) as information and knowledge sharing requires physical proximity. Girma *et al.* (2008) found that industries that are characterized by a high growth of domestic-oriented FDI also show evidence of positive horizontal spillovers from domestic market oriented FDI. They explained this fact with the probability that foreign investors in such industries are competing with each other rather than with the local enterprises, hence enabling them to learn the new technology brought into the economy.

One of the explanations for lack of adequate evidence on horizontal spillover lies with the unwillingness of multinational companies (MNCs) to share knowledge with rivals. Javorcik and Spatareanu (2005) noted that if domestic firms and MNCs operate in the same sector, MNCs have the incentive to prevent spillover through intellectual property, trade secrecy, paying higher wages for employees to prevent them moving to other firms, or by operating in industries or countries where local firms have limited capability to compete. Similarly, using game theoretic model, Fosfuri *et al.* (2001) proved that technological spillovers arise only if domestic and foreign firms do not compete fiercely in the product market, when on-the-job training is general rather than specific, and when the absorptive capacity of the local firm is high. On the other hand, there is no incentive for MNCs to prevent technology flows to the upstream sector as they expect benefits from linkages, which also improve the performance of local firms through improving the quality of intermediate inputs supplied (Javorcik and Spatareanu, 2005). In spillover literatures, there seems to be more difficulty in explaining the mechanism through which developing host country firms may benefit from horizontal spillovers. Imitation, skills acquisition, competition, and export orientation are among the most commonly discussed channels (Görg and Greenaway, 2004).

Three major channels of spillovers have been identified by Blomström and Kokko (1998). The first occurs when highly skilled manpower from foreign firms move to domestic firms and apply their knowledge in the domestic firms. In line with this, Fosfuri *et al.* (2001) and Hale and Long (2006) have empirically proved the importance of movement of high-skilled workers and the corresponding knowledge externalities in facilitating horizontal spillover. The second is termed “demonstration effects,” which results from arm’s-length-relationships between foreign and domestic firms, whereby the latter learns superior production technologies from the former. The third channel is called “competition effect,” which results from increased entry of foreign firms into a sector. This would stimulate increased use of better technologies and more effective use of resources among domestic firms, which in turn raise productivity. The extent and the direction of the spillover effect that would pursue any of these channels may vary with country, sector, or other firm characteristics.

However, there could be a negative competition effect, especially in developing countries, if foreign firms attract demand away from local firms (Blomström and Kokko, 1998; Aitken and Harrison, 1999; Görg *et al.,* 2009). In most of the cases, both negative and positive effects may coexist. For instance, Javorcik and Spatareanu (2005) found incidences of positive demonstration effect along with negative competition effect of MNCs on domestic firms. In Chinese manufacturing, demonstration and contagion effects were found to be the important channel of technology transfer for collective- and private-owned enterprises while competition effect was more useful for SOEs (Li *et al.,* 2001). With respect to market orientation, they indicated that local market-oriented FDI benefits local firms mainly through competition.

In their famous paper, Aitken and Harrison (1999) analyzed Venezuelan plant-level data, covering the period between 1976 and 1989, and found that foreign investment negatively affects the productivity of domestically owned plants. However, Keller (2001) questioned this result in view of the possibility of model miss-specification and the simultaneity effect arising from the potential selection of multinationals into industries where domestic competitors are structurally weak. Using Colombian manufacturing census, Kugler (2006) also found no intra-industrial spillover effect but inter-industry spillover through linkages with upstream local firms. Similarly, Bwalya (2006) found a positive significant effect of vertical productivity spillovers from FDI in Zambia along with negative and significant effects of horizontal spillovers. However, the result changed into a positive but insignificant effect upon controlling for a variable that represents regional concentration of foreign firms. Using panel data from Bulgaria, Romania, and Poland, Konings (2001) found no evidence of positive spillover to domestic firms. Rather, he found negative spillover in Bulgarian and Romanian firms.

In their review of empirical works, Blomstrom and Kokko (1998) and Javorcik and Spatareanu (2005) have identified the importance of local conditions in host countries in FDI spillover. If there is good competitive environment and good absorptive capacity in the host country, the benefits from FDI would be significant. Crespo and Fontoura (2007) have also shown that characteristics of the particular region and country and their development levels are important for the occurrence of the spillover. The more crucial thing for a country is its distance from the global technology frontier (Findlay, 1978; Glass and Saggi, 1998). For Glass and Saggi (1998), the further a country is from the global technological frontier, the more difficult is its ability to benefit from foreign technologies and the lower is its competitiveness in the international market. Findlay (1978), however, sees the reverse relationship arguing that the more a country is behind the technological frontier, the higher is its opportunity to benefit from other developed countries' technology. Trade openness, level of human development, and the intellectual property (IP) regimes of a country also determine horizontal spillover. Iršova and Havrànek (2013) found that higher trade openness and patent rights have a strong negative effect on FDI spillover. In relation to human development, however, they found positive and significant effects. According to Girma and Wakelin (2007), not only do country conditions but also regional differences within a country have strong effects on both horizontal and vertical spillovers. They found that local firms benefit from high foreign presence only if they are in a proximate location.

Nevertheless, there are many cases of positive horizontal spillover effects of FDI on productivity, regardless of year and differences in the level of countries' development. For instance, Sjöholm (1999) and Suyanto *et al.* (2009) found positive productivity spillover for Indonesian firms. Applying panel fixed effects regression, Belderbos and Van Roy (2011) also confirmed positive productivity effect of high presence of foreign multinationals on local Belgian firms. More importantly, poor countries with weak local industrial capabilities, industrial development, in general, and technological capability building, in particular, depends on foreign technologies that mainly transfer through FDI (Lall, 1992). Besides, FDI promotion is among the selective interventions permissible by WTO, in addition to skill formation, research and development (R&D), and targeting or IT infrastructure. However, poor capabilities of less developed countries (in terms of skill formation, R&D, and IT infrastructure) forced these countries to become over dependent on FDI (Lall, 2006).

Therefore, it is logical to expect positive productivity effect of FDI on domestic firms in Ethiopia.

Hypothesis 1a: *High presence of foreign firms in a sector increases the productivity of domestic firms in the sector.*

Similar to its effect on productivity, spillover effects can be positive or negative on firm growth depending on the size of the advantages and the disadvantages from entry of foreign firms. However, the fact that we expected a positive effect of FDI on productivity and the empirical regularity that more productive firms are likely to grow faster than low productive firms, we hypothesize the following.

Hypothesis 2a: *High presence of foreign firms in a sector increases the growth rate of domestic firms in the sector.*

Empirical findings so far have generally reported mixed results with respect to horizontal FDI spillover (Görg and Greenaway, 2004; Crespo and Fontoura, 2007; Smeets, 2008). It is indeed difficult to derive a universal conclusion on horizontal spillover due to many dimensions and many factors at the country, sector, regional, and firm level that affect the relation between FDI and knowledge spillovers (Iršova and Havrànek, 2013). Recent studies show that if firm-level data are disaggregated on country, region, sector, ownership, time, and other relevant firm-level characteristics, one can get the real spillover effect. For instance, Damijan *et al.* (2013) has shown positive horizontal spillover effects upon disaggregating data from 10 transition economies: by country, sector, ownership, productivity, absorptive capacity, and size. Given the country differences, it is important to control for the important firm characteristics that affect FDI spillover while testing the above hypotheses. We now turn to elaborating some of these factors.

6.2.1.1 Ownership of firms

The extent and type of foreign ownership is important for vertical spillover. Javorcik and Spatareanu (2008) found a positive correlation between the change in the presence of partially owned foreign firms in downstream sectors and the productivity growth of local firms in the upstream sector. They did not find such effect for wholly owned foreign subsidiaries in downstream sectors. Regarding horizontal spillover, they indicated that the change in the presence of wholly owned foreign affiliates has a larger negative effect on the productivity growth of Romanian firms in the same sector than the entry of partially owned foreign enterprises (Javorcik and Spatareanu, 2008). Similarly, in the Chinese firm-level analysis in Abraham *et al.* (2010) and the meta-analysis of Iršova and Havrànek (2013), it was found that investment projects in the form of joint ventures with domestic firms are associated with more positive spillovers than fully foreign-owned projects.

In China, non-state-owned local firms benefit more from FDI in labor-intensive sector while state-owned firms receive more positive horizontal spillover in capital intensive sector (Buckley *et al.*, 2007). Upon classifying foreign affiliates (FAs) based on their countries of origin, they found that in labor-intensive industries, HMT (Hong Kong, Macau, and Taiwan affiliates) or overseas Chinese generate more positive spillovers to local firms than western affiliates. Surprisingly, conflicting results emerge for the same Chinese manufacturing by Lin *et al.* (2009), perhaps due to differences in the disaggregation of the firms into labor-intensive and capital-intensive sectors, and state-owned and non-state-owned categories. Their result shows that FDI originated HMT generate negative horizontal spillovers, while non-HMT foreign firms (mainly from OECD countries) tend to have positive horizontal spillovers in Chinese firms. They also found strong and robust forward spillover effects from both HMT and non-HMT firms with the effect being stronger from the latter group.

6.2.1.2 Input intensity

There is evidence in literature that local firms seem to benefit from capital-intensive technologies than labor-intensive technologies (Görg *et al.*, 2009; Buckley *et al.*, 2007). Buckley *et al.* (2007) argues that if FAs operate in labor-intensive sectors, the assumed superiority of technology in FAs seems to matter less. They related the likely benefits from such FAs, in these industries, in terms of their ability to adapt mature technologies to more labor-intensive contexts, and to local raw materials and marketing skills that enable the delivery of timely and uniform quality products to western markets. By this, they seem to overlook the potential effect of workers mobility and competition. The effects are also likely to vary between long term and short term. In relation to this, Liu (2008) examined the short-term (the level) and long-term (the rate) effect of FDI in a sector. His estimates show that an increase in FDI in the sector at the four-digit level lowers the short-term productivity level but raises the long-term rate of productivity growth of domestic Chinese firms.

6.2.1.3 Size and productivity

At firm-level, firm size and productivity are among the important determinants of spillover as they are related to firms' absorptive capacity (Murakami, 2007). Görg *et al.* (2009) showed that large firms benefit more from FDI spillover than small firms. Damijan *et al.* (2013) show that positive horizontal spillovers are more likely to prevail in medium or high productivity firms while negative horizontal spillovers are more likely to affect low to medium productivity firms. However, they found no effect of firm size classes in positive horizontal spillovers while negative horizontal spillovers seem to be more likely for smaller firms.

6.2.1.4 Market orientation of foreign firms

Literatures also demonstrate the importance of market orientation of foreign firms on local firms' productivity (Li *et al.*, 2001). It is assumed that foreign firms that operate to serve domestic market can exert negative effect on domestic firms. For instance, Görg *et al.* (2009) indicated that local market-oriented FDI has negative productivity effect on all domestic firms while there is no spillover from export orientation. However, they found large exporting firms to be more likely to benefit than non-exporting firms. Even though domestic market-oriented foreign firms are more likely to have a negative effect, Li *et al.* (2001) have shown the possibility of positive benefits for local Chinese firms through competition. Firms with experiences in the international market perform better than firms with no such experiences (Van Beveren and Vanormelingen, 2014).

6.2.1.5 Absorptive capacity and technological gap

In their survey of literatures, Crespo and Fontoura (2007) indicated that absorptive capacity of domestic firms and the influence of the technological gap between foreign and domestic firms are the two most important factors in determining FDI spillovers. This fact is rooted on the basic definition that absorptive capacity is the ability of firms to identify available technologies, adapt and utilize them for commercial purposes (Cohen and Levinthal, 1989, 1990, and 1994). Konings (2001) noted that technological spillover is more likely to occur in sectors with high R&D and firms that have initially sufficient knowledge. Many other empirical works (Mayer, 2004; Hale and Long, 2006; Kugler, 2006; Murakami, 2007; Lopez-Garcia and Montero, 2012; Seyoum *et al.*, 2015) also found positive significant effects of absorptive capacity on FDI spillover. Using data from transition economies, Damijan *et al.* (2013) also found robust evidence on the importance of technology gaps and absorptive capacity in determining spillover effect of FDI on local firms. They showed that horizontal spillovers are mostly negative if absorptive capacity is not accounted for. However, after controlling absorptive capacity, firms in 60–70% of the countries were found to have benefited from high competition of foreign firms in the same sectors. In some cases (Girma and Wakelin, 2007), the effect of absorptive capacity on productivity is U-shaped, showing higher effect on the extreme ends of productivity quantiles.

With respect to the technology gap, there are two different theoretical grounds. One relates to the idea of absorptive capacity whereby firms with lower gaps in their technology are supposed to have higher absorptive capacity and hence enjoy more spillover. The other is based on the technological catch-up hypothesis, which argues that high technological gaps between domestic and foreign firms offer higher opportunities for domestic firms to improve their levels of efficiency through imitation of foreign technology (Findlay, 1978). Unlike the two extremes, Crespo and Fontoura (2007) argue that technology gap should not be too high or too low favoring some optimal level of the gap so that domestic firms possess the capacity to absorb technologies. Nevertheless, more evidence (including Hale and Long, 2006; Buckley *et al.*, 2007; Murakami, 2007) seem to support the idea that high technology gap is associated with low or negative FDI spillover. Besides, Iršova and Havrànek (2013) confirmed this fact using meta-regression analysis.

Based on the empirical evidences, Smeets (2008) concluded that the mediating role of absorptive capacity and technology gaps in knowledge spillover is still inconclusive and results are difficult to compare because of differences in methodologies and measurements. However, theoretical literatures suggest that there should be adequate absorptive capacity among domestic firms to acquire knowledge from FDI (Fu, Pietrobelli, and Soete, 2011). Based on these, we expect that high absorptive capacity of domestic firms involves positive spillover from FDI. Thus, we hypothesize that

> Hypothesis 1b: *Firms with high relative productivity benefits more from foreign presence than firms with lower relative productivity*

> Hypothesis 2b: *The effect of FDI on sales growth is higher for firms with high relative productivity than firms with lower relative productivity*

Since differences in the technological capacity of domestic firms are often proxied by differences in their productivity or efficiency levels (Damijan *et al.*, 2013), we will test Hypotheses 1b and 2b through interacting gaps in productivity (or efficiency) with FDI. The interaction of the FDI variable with firm characteristics allows the spillovers to vary across firms depending on their heterogeneity (Farole and Winklery, 2014). The detail of the data and methodology to test the above hypotheses are presented below.

6.3. METHODOLOGY

6.3.1. DATA SOURCE

In order to test the above hypotheses, we used census of manufacturing establishments in Ethiopia gathered by Central Statistical Agency (CSA). For our purpose, we utilized only data after 2001/2002 up to 2010/2011, which is unbalanced. The data contains detailed information about firms in the manufacturing sector, which employs 10 and above permanent workers. Important variables like firm's sector, sales, years of establishment, ownership, initial paid up capital, current paid up capital, industrial and non-industrial costs, export sales, import of raw materials, inputs used, investment in fixed assets, merchandize inventory, etc. are available in the dataset. Secondary data from the World Development Indicator were also used as the additional source most importantly for the purpose of deflation in variable construction. We used a two-digit and four-digit International Standard

Industrial Classification (ISIC) for the purpose of computing sectoral variables and comparison of sectoral performance. Industry concentration and mean comparison between sectors are solely based on two-digit classification while the variables used to measure foreign presence are computed for both two- and four-digit classifications. In the dataset, manufacturing of food is the largest sector followed by furniture production and other non-metallic products, respectively.

6.3.2. DESCRIPTION OF VARIABLES

Output (y): is the gross value of production, which is computed as the sum of sales revenue and change in stock during the year. We used the usual way of deflation using sector-specific product deflator following the methodology adopted by the Ethiopian Ministry of Finance and Economic Development taking 2000 as a base year.

Labor (L):is an input, which is measured in terms of the number of permanent employees.

Capital (k): was constructed using the formula,

$$k_{it} = k_{it-1} + \frac{Inv_{it}}{capD_{it}} - D_{it} - disposed_{it}$$

where *inv* is investment in capital during a year, D is depreciation during the year and *disposed* is capitals disposed of during the year, and *capD* is an implicit fixed capital deflator computed from the World Bank's database on capital formation. It is computed as the ratio of gross capital formation at current local currency to gross capital formation at constant local currency (using year 2000 prices as a base). The *i*, *0,* and *t* subscripts stand for firms' identity, initial period, and time period, respectively.

Intermediate inputs (M): this variable was computed as the sum of expenditures on all raw materials, energy inputs including electricity, water, and other industrial and non-industrial expenditures. To find its real value, we deflated using implicit GDP deflator from the World Banks Development Indicator database taking 2000 as a base year.

Foreign ownership (Foreigner): is a dummy variable constructed by assigning value 1 if foreigners have stock in the current total paid-up capital of a firm and 0 otherwise.

Private ownership (Private): is a dummy variable constructed by assigning value 1 if the ratio of government paid-up capital to the current total paid-up capital of a firm is lower than 0.5 (50%) and 0 otherwise. We used this categorization even if there is a separate variable that captures this ownership issue in the dataset due to inconsistencies observed in the dataset and difficulties in differentiating some of the enterprises as either private or public in some cases for Ethiopia.

Foreign Direct Investment (FDI): is a sector-level variable to measure foreign presence computed as the proportion of equity owned by foreign investors in a sector following Aitken and Harrison (1999). It is computed by taking the ratio of total foreigners-owned current paid-up capital in a sector to the total current paid-up capital in the sector for a two- and four-digit ISIC classification and denoted by FDI. It can be written mathematically as:

$$FDI = \frac{\sum_{f=1}^{n} CPC_{fjt}}{\sum_{i=1}^{N} CPC_{ijt}}$$

where *CPA* is the current paid-up capital in Ethiopian Birr, *f* denotes foreign ownership, *i* is any firm, *n* is the number of foreign-owned firms in sector *j* year *t,* and N is the total number of firms in sector *j,* year *t.*

Concentration Index (CI): is a sectoral variable constructed as the sum of the first four largest firms' market share in the sector, which can be given as:

$$CI = \frac{\sum_{i=1}^{4} q_{ij}}{Q_j}$$

Where q_{ij} is the market share of firm *i* in sector *j* and *i* running from 1 to 4 indicates that the first four largest firms in market share are taken. Q_j is the total sales of sector *j*. Note that CI was computed using all firms in the country to reveal the real competition in the manufacturing sector.

Exporter: is a firm-level variable assigned value 1 if the firm is engaged in export and 0 otherwise.

Size: is the natural legalism of the number of permanent full-time employees of a firm.

Relative Productivity (REL_{TFP}): is a firm-level variable (a measure of absorptive capacity) computed as the difference between the logarithm of a firm's TFP and the maximum TFP in a two-digit ISIC classified industry for each year following Girma (2005) using the formula,

$$REL_{TFP} = \log\left(\frac{TFP_{ijt}}{MaxTFP_{jt}}\right)$$

Where TFP_{ijt} is the total factor productivity of firm *i* in sector *j* and year *t*; $MaxTFP_{jt}$ is the maximum TFP in sector *j* year *t*. The justification of using REL_{TFP} as a measure of absorptive capacity stems from the fact that a firm acquires absorptive capacity, mainly by investing in R&D and human capital (Cohen and Levinthal, 1989). Murakami (2007) and Lopez-Garcia and Montero (2012) also indicated that absorptive capacity of a firm is determined by its size, TFP level, skilled-labor ratio, on-job training, and R&D intensity. Particularly, as productivity is higher in firms that invest in human capital and technology (Van Beveren and Vanormelingen, 2014), we can use REL_{TFP} to measure absorptive capacity.

Dummy for high Efficiency gap (EFG): is a firm-level dummy variable that takes value 1 if a firm's efficiency gap is higher than the mean value (0.54) and 0 otherwise. It is the variable we believe to proxy firms' technology gap. This variable was computed in two steps where we first computed efficiency scores for each firm using Wang and Ho's (2010) approach of estimating fixed effect panel stochastic frontier. Then we computed efficiency gap (EFG), before generating the dummy, as the difference between the maximum efficiency in sector j year t (maxEFFjt) and efficiency of firm i at year t (EFF_{it}) as:

$$\text{Efficiency gap} = maxEFF_{jt} - EFF_{it}$$

6.3.3. THE EMPIRICAL MODELS

In order to measure the performance of firms in the Ethiopian manufacturing sector, we use two measures of performance. These are sales growth, and total factor productivity (TFP). In this section, we present the estimation strategies of each measure.

Total factor productivity estimation (TFP)

In empirical studies, TFP is computed as the residual of production function with diverse specifications. However, the computation of TFP has no unified or limitation-free approach. There are different ways of computations starting from non-parametric index number methods, semi-parametric, and fully parametric methods. The comparative review of the methods is in Van Biesebroeck (2007). We start from the Cobb-Douglass production function specification as:

$$Y_{it} = A_{it} K_{it}^{\beta_k} L_{it}^{\beta_l} M_{it}^{\beta_m} \qquad 6.1$$

where Y_{it} represents output of firm i in period t; K_{it}, L_{it}, and M_{it} are inputs of capital, labor, and materials respectively, and A_{it} is the Hicksian neutral efficiency level of firm *i* in period *t*. Taking natural logs of (6.1) results in a linear function given as

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \varepsilon_{it} \qquad 6.2$$

According to Van Beveren (2010), estimation of equation (6.2) using OLS leads to omitted variables bias because of the correlation of firm's inputs choice with unobserved firm-specific productivity shocks. Provided that productivity is time-invariant, adding firm fixed effects into the estimation could solve the problem. However, this strategy is not appropriate if our concern is on firm-level productivity change. Among the alternative estimation strategies developed in literatures, Levinsohn and Petrin (2003) method is well known to solve such problems. Levinsohn and Petrin (2003) rewrite equation (6.2) as

$$y_{it} = \beta_0 + \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \omega_{it} + \eta_{it} \qquad 6.3$$

The error has two components: the transmitted productivity component given as ω_t and η_t, an error term that is uncorrelated with input choices. The former component is a state variable that affects the firm's choices of inputs. Thus, it leads to the well-known simultaneity problem in production function estimation. Any estimators ignoring this correlation between inputs and this unobservable factor will yield inconsistent results. Assuming a Cobb Douglas production function, Levinsohn and Petrin (2003) use the firm's raw material inputs to correct for the simultaneity in the production function. Invoking the assumption that demand for the intermediate input m_t depends on the firm's state variables k_t and ω_t: $mt = mt(kt, \omega t)$.With mild assumption about the production function, they show that the demand function is monotonically increasing in ω_t, which allows for the inversion of the demand function and is written as:

$$\omega_{it} = \omega_{it}(k_{it}, m_{it}) \qquad 6.4$$

The last identification restriction Levinsohn and Petrin (2003) made was that productivity is governed by a first-order Markov process:

$$\omega_{it} = E[\omega_{it}|\omega_{it-1}] + \xi_{it} \qquad 6.5$$

We followed this approach in computing the TFP. After estimating the TFP we will also fit a regression of TFP on FDI while controlling for the common determinants of productivity, which can be written as:

$$\begin{aligned} TFP_{it} = \beta_0 + \beta_1 export_{it} + \beta_3 FDI_{it} + \beta_3 FDIxREL_{TFP_{it}} + \beta_5 lage_{it} + \beta_6 size \\ + \beta_7 private + \beta_8 CI \\ + \beta_j \delta_i + \varphi_{it} \qquad 6.6 \end{aligned}$$

Where *export* is a dummy for export; FDI is a measure of foreign presence; $\mathrm{FDIxREL_{TFP}}$ is the interaction between FDI and relative productivity that would measure absorptive capacity. The positive coefficient of this term indicates that spillover effect is higher for firms with higher absorptive capacity (Cohen and Levinthal, 1989). *lage* is the natural logarithm of age of the firm since its establishment; δ_i are dummies for sector and year; andφ is a random error term. Variables *lage, export, size, private, CI,* and the dummies for year and sector are included to control for the heterogeneity of firms. We added year dummies to capture macro productivity shocks, two-digit industry affiliation to account for the sectoral effect of productivity. Without year and industry, positive coefficients on the FDI variables could simply reflect the tendency of foreign firms to invest in high productivity sector or favorable macroeconomic environments (Girma and Wakelin, 2007).

However, estimating equation (6.6) using OLS and fixed or random effect models leads to dynamic panel bias due to the correlation of the lagged value of productivity with firm fixed effect (Roodman, 2009). The RHS variables would not be exogenous as they are required for consistency of estimators. Time-invariant firm characteristics (fixed effects), such as sector and managerial skills, may be correlated with the explanatory variables. Thus there will be endogeneity and reverse causality. Roodman (2009) indicated that some of the approaches like least square dummy variable (LSDV) and instrumental variable solve the problem partially. Specifically, he pointed out that LSDV works only for balanced panels and does not address the potential endogeneity of other regressors. Arellano and Bond (1991) developed a generalized method of moment (GMM) technique that eliminates the bias through transformation of the variables. Furthermore, Blundell and Bond (1998, 2000) improved the estimation method noting that the validity of instruments from first differencing transformation may suffer in cases where input and output variable are persistent. They developed a system GMM that uses more moment conditions from lagged first difference of the dependent and independent variables. In this paper, we specifically used a one-step system GMM with heteroscedasticity consistent standard errors.

According to Roodman (2009), of the two available transformations, namely, different transformation and forward orthogonal deviations, the former has limitations especially in the case of unbalanced panel data since it leads to loss of some data due to the transformation. Thus, we apply the second option for unbalanced data, which is computable for every observation except the last for each firm thereby minimizing loss of data. After the system GMM estimation, we apply the Arellano and Bond tests of autocorrelation and the Sargan/Hansen test for joint validity of the instruments, which are standard after GMM (Roodman, 2009).

The sales growth model

In addition to TFP, we used sales growth (*growth*) as the dependent variable to analyze the effect of FDI. The growth equation is specified as:

$$\ln\left(\frac{S_t - S_{t-j}}{S_{t-j}}\right) = f(size, age, export, FDI, REL_{TFP}, CI, Private, sector, year) + \varepsilon_{it} \;\ldots\; 6.7$$

Where S_t is sales in year *t*, S_{t-j} is *j* period lagged value of sales; ε is a stochastic error term. The RHS variables include age of the firm, lagged value of firm size, export dummy, concentration index (CI), relative productivity (REL_{TFP}), and dummies for private ownership, year, and sector.

6.4. RESULTS AND DISCUSSION

This section presents regression outputs of the above econometric models (equations 6.6 and 6.7) fitted for total factor productivity (TFP) and sales growth (growth).[11] Before the econometric results, however, let us examine some descriptive aspects with respect to sectors of economic activity and the major variables of interest in relation to the two dependent variables. When we look at the sectoral differences in TFP and growth (Table 6.1), the mean value of sales growth is the highest for wood and wood products followed by chemicals and other non-metallic minerals, while it is least for motor vehicle and trailers. The mean growth rate of sales in the manufacturing sector is only 1.6%. In terms of TFP, basic iron and steel, textile, and paper and paper products occupy first to third ranks, respectively. The overall mean TFP of the manufacturing sector is about 6.7 log points.

isic code	sector	**No. of Obs.**	**Salegr (%age)**	**TFP(log)**
15	Foods and Beverages	3,297	1.58%	6.96
17	Textile	342	0.98%	7.42
18	Wearing Apparel	301	1.19%	6.44
19	Leather and Leather Products	670	0.83%	6.95
20	Wood Products	218	2.24%	6.20
21	Paper Products	902	1.51%	7.08
24	Chemicals	584	2.12%	6.98
25	Rubber and Plastic	645	2.09%	6.75
26	Other Non-Metallic Mineral	1,708	2.12%	6.33
27	Basic Iron and Steel	146	1.25%	7.66
28	Fabricated Metal	637	1.03%	5.60
29	Machinery and Equipment	66	2.02%	6.40
34	Motor Vehicles and Trailers	74	0.33%	6.98
36	Furniture	1,621	1.45%	6.39
	Total	**11211**	**1.59%**	**6.69**

Table 6.1 Sectoral mean of sales growth and TFP

[11] The econometric results are generated through a tedious process of estimation and selection among various outputs of the extended system-generalized method of moments (SYSGMM) as the best alternative models after passing rigorous statistical tests as explained in the methodology section. Results were compared, also, against the traditional fixed effect and pooled ordinary linear regression models. Therefore, results to be presented below were carefully selected and interpreted.

Before the econometric analysis, it is imperative also to look at the preliminary relationship between the selected performance indicators and their potential determinants. This was done using a two group mean comparison test and presented in Tables 6.2 and 6.3. In order to make the comparison test, we have created binary groups out of continuous variables by generating dummies of the respective variables based on their mean values. The generation of group variables from continuous variables was done in such a way that firms with the value of the variable exceeding mean value are categorized into one group and those with less or equal to the mean value are included in the other group. Three variables, namely, exporter, private, and foreign, were already dummies to identify groups.

Sales growth					
	Group	**Obs.**	**mean**	**Diff**	**t-values**
Size	small firm	4709	0.012		
	large firm	4195	0.020	-0.007	(-3.817)***
Age	young firm	3785	0.021		
	Old firm	5119	0.012	0.009	(4.445)***
Concentration	low	6073	0.015		
	high	2831	0.018	-0.003	(-1.691)*
Export	Non-exporter	8412	0.015		
	Exporter	492	0.025	-0.010	(-2.246)**
Ownership	Public	951	0.006		
	Private	7953	0.017	-0.011	-(3.751)***
Ownership	Local	8540	0.016		
	Foreign	364	0.017	-0.001	(-0.267)
Foreign Presence	Low	5142	0.016		
	High	3762	0.015	0.001	(0.719)

Table 6.2 Test on mean difference of sales growth

Note: ***, **,* stands for 1%, 5%, and 10% levels of significance, respectively

Table 6.2 shows that firms that invest in fixed capital asset can significantly achieve more growth in sales than those with no investment. Younger and larger firms grow faster than older and smaller firms, respectively. Firms in more concentrated sectors and firms engaged in the export market also enjoy significantly higher growth in sales. In terms of ownership, private-owned firms have significantly higher mean growth in sales than public-owned firms. On the other hand, there is no significant difference in sales growth between foreign and local and firms in sectors with tense foreign presence and sectors with less or no foreign firms at all.

The effects of size and export on total factor productivity (TFP) are similar to their effect on sales growth (Table 6.3). However the effect of market concentration on

TFP is at odds with its relation to sales growth. According to the mean comparison test, firms in less concentrated sectors are significantly higher than firms in more concentrated sectors. Due to the fact that concentration is a sectoral variable, we have to be cautious not to take this preliminary result for granted as it does not allow for controlling sector effects. As it will be seen in the econometric section, the relationship is the other way round after controlling sector effect.

Total Factor Productivity					
	Group	**Obs.**	**Mean**	**diff**	**t-value**
Size	small firm	6270	6.425		
	large firm	4941	7.036	-0.611	(-33.15)***
Age	young firm	5351	6.584		
	Old firm	5860	6.794	-0.210	(-11.00)***
Concentration	low Concentration	7337	6.806		
	high Concentration	3874	6.483	0.323	(16.20)***
Export	None-exporter	10822	6.640		
	Exporters	575	7.492	-0.852	(-19.74)***
Ownership	Private	10398	6.628		
	Public	999	7.259	-0.631	(-18.86)***
Ownership	Local	10973	6.674		
	Foreign	424	6.914	-0.240	(-4.73)***
Foreign Presence	Low	6784	6.655		
	High	4427	6.754	-0.099	(-5.04)***

Note: ***, **,* stands for 1%, 5%, and 10% levels of significance, respectively

Table 6.3 Test on mean difference of total factor productivity

It is also important to note the important difference in the results of growth (Table 6.2) and that of TFP (Table 6.3) in relation to the remaining variables. The age of the firm, which was negatively related with growth, turned out to be positive and significant in affecting TFP. Unlike sales growth, TFP is significantly higher for public enterprises than private firms and for foreign firms than local firms. Similarly, tense presence of foreign firms in a sector is associated with significantly (1% level) higher TFP of firms in the sector. The above descriptive analysis gives some useful information to substantiate the econometric result. In what follows, we present the econometric results.

6.4.1. TOTAL FACTOR PRODUCTIVITY AND SPILLOVER EFFECT

In this section, we try to test the first two hypotheses (1a and 1b) regarding the productivity effect of FDI on domestic firms. The productivity is measured by the TFP level as computed by the Levisohon and Petrin (2003) approach in the first step of our estimation strategy. This section analyzes results of the second-step regression where TFP is the dependent variable. The independent variables are FDI and other firm characteristics to control for heterogeneity of firms. In order to see the heterogeneity of the effect of FDI along varying levels of firm performance, we included the interaction of FDI with $REL_{TFP.}$ To check the robustness of the result, we used the interaction of FDI with efficiency gap (EFG).

In spillover literatures, scholars categorize spillover effect into positive externality and negative competition effect. The superiority of foreign firms in terms of both technology and human skills would give local firms the opportunity to learn on the one hand and steal demand from local firms on the other. If the learning effect is higher than the demand stealing effect, there will be positive total effect of FDI. The following table (Table 6.4) displays the total effect of FDI on productivity.

As can be seen from the table, the SYSGMM was robustly estimated as the Hansen test and Arellano and Bond test of autocorrelations (AR), respectively, indicate that all the instruments used are valid and there is no second order autocorrelation. All standard errors are robust (RSE). The results were compared also against the traditional fixed effect and pooled OLS estimates (not reported here). Results in Table 6.4 are given in 6 columns with alternatives that help check the rigor of our estimates. Columns 1 and 2 are estimates with FDI computed at two-digit sectoral classification. Column 2 includes the interaction between FDI and REL_{TFP} in addition to variables that appeared in Column 1. Columns 3 to 6 are estimation results with FDI computed at four-digit sectoral classification. Column 3 was estimated without interaction term while 4 and 5 differ only due to absence of CI in 4. Column 6 was estimated with alternative interaction term (*FDIxEFG* instead of *FDIxRELTFP*).

The positive significance of one year lagged value of TFP in all the columns indicates the persistence of productivity over time. Export orientation, size, ownership, age, and market structure are among the most important variables that account for variations in productivity. Thus we controlled the effect of these variables to see the effect of FDI. The results indicate that except ownership, all the control variables are positively and strongly significant in determining productivity. That is, firms that export goods, larger firms, older firms, and firms in more concentrated sectors are more productive than their comparators. The negative sign (but insignificant) of *Private* dummy shows that private-owned firms are less productive than public-owned firms. In all the results, the coefficients of FDI variable are positive and strongly significant (except column 3) in determining productivity indicating the presence of positive horizontal spillover effect regardless of the levels of industrial classification. It means that local firms in sectors with high proportion of foreign capital are more productive than firms in sectors with low foreign capital leading to confirmation of Hypothesis 1a. Besides, there is evidence of differences in the effect of FDI with relative performance of firms in line with Hypothesis 1b. We interpret differences in relative performance in accordance with absorptive capacity. The results generally show that there is a positive learning effect of FDI that appeared to be stronger for firms with higher capability or absorptive capacity.

	(1)	(2)	(3)	(4)	(5)	(6)
TFP	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)
TFP_{t-1}	0.127^{***}	0.074^{***}	0.085^{**}	0.125^{**}	0.108^{***}	0.104^{***}
	(0.041)	(0.019)	(0.043)	(0.053)	(0.040)	(0.039)
Export	0.373^{***}	0.261^{***}	0.389^{***}	0.254^{**}	0.308^{***}	0.339^{***}
	(0.122)	(0.081)	(0.121)	(0.123)	(0.108)	(0.113)
lnage	0.032^{**}	-0.003	0.038^{**}	0.040^{**}	0.036^{**}	0.035^{**}
	(0.015)	(0.008)	(0.016)	(0.016)	(0.015)	(0.016)
size	0.178^{***}	0.122^{***}	0.166^{***}	0.158^{***}	0.168^{***}	0.151^{***}
	(0.032)	(0.021)	(0.033)	(0.037)	(0.029)	(0.029)
Private	-0.023	-0.079	-0.064	-0.034	-0.017	-0.032
	(0.080)	(0.052)	(0.087)	(0.088)	(0.076)	(0.076)
FDI	0.930^{***}	1.206^{***}	0.048	2.752^{***}	3.186^{***}	1.427^{***}
	(0.332)	(0.193)	(0.321)	(0.449)	(0.404)	(0.373)
$FDIxREL_{TFP}$		-1.430^{***}		1.801^{***}	1.837^{***}	
		(0.071)		(0.224)	(0.182)	
FDIxEFG						-3.258^{***}
						(0.593)
CI	1.662^{***}	0.776^{***}	1.769^{***}		1.839^{***}	1.651^{***}
	(0.402)	(0.255)	(0.423)		(0.397)	(0.418)
_cons	5.217^{***}	7.390^{***}	5.612^{***}	5.834^{***}	5.413^{***}	5.558^{***}
	(0.289)	(0.230)	(0.318)	(0.354)	(0.275)	(0.280)
Dummies	Year & sector					
No. of obs	7223	7223	7222	7222	7222	7222
No. of firms	2074	2074	2074	2074	2074	2074
No. of ins	932	1103	860	588	960	958
AR(1)	0.000	0.000	0.000	0.000	0.000	0.000
AR(2)	0.986	0.135	0.870	0.277	0.540	0.612
Hansen test	0.213	0.114	0.230	0.138	0.353	0.330

Note: ***, **, * stands for 1%, 5%, and 10% levels of significance, respectively.

Table 6.4 Regression result (SYSGMM) on TFP

In Table 6.4, the interaction term $FDIxREL_{TFP}$ is positive and significant at less than 1% levels in Columns 4 and 5. This indicates that the effect of FDI is stronger for firms with high relative productivity (or absorptive capacity). Similar findings emerged from estimates in Column 6 where we used *FDIxEFG* as an alternative way of examining the heterogeneity of the effect of FDI. The negative and strong significance of the coefficient of this term shows that the higher the gap in relative efficiency of firms, the lower is the effect of FDI. In other words, firms with better efficiency benefit more from FDI than less efficient firms. This can be directly interpreted again in line with the technology gap hypothesis. Nevertheless, the two alternative interaction variables tell us similar stories that firms with better relative performances reap more benefit from externalities. In view of the definition of dynamic absorptive capacity (Cohen and Levinthal, 1990), higher productivity and efficiency implies high absorptive capacity. Therefore, the result is in line with the empirical regularity that absorptive capacity is the most important factor in spillover effect.

However, having higher absorptive capacity does not necessarily involve positive externality from FDI. There are ample empirical evidences of higher negative competition effect over positive effect, specially, for horizontal spillover. The result in Column 2 has a signal of this fact when the FDI variable is computed at two-digit level industrial classification. Particularly, the negative and strong significance of the coefficient of the interaction term $FDIxREL_{TFP}$ indicates that the benefit of FDI is lower among local firms with higher relative productivity. This could be seen as a support for Glass and Saggi's (1998) argument, that spillover effect occurs better with optimal differences in the technology of local and foreign firms than in case of extreme gaps. This could be due to the fact that the negative competition effect from foreign firms is higher than the benefit obtained from the foreign firms among local firms, which are close to the frontier firms. The competition could be in terms of productive resources and market share at which foreign firms are more likely to benefit more. This is more visible in the case of growth of firms as can be seen in the following section.

6.4.2. SALES GROWTH AND FDI SPILLOVER

Similar to the above table, the results provided in Table 6.6 were robustly estimated as the AR and Hansen tests show. Results in the table are used to test Hypotheses 2a and 2b. Columns 1–3 display results of regression when FDI is computed at four-level ISIC, while those in Columns 4 and 5 were estimated with two-digit ISIC. Column 1 is without the interaction term, while Columns 2 and 3 included two different interaction terms to check the robustness of the results. The major variables known in literature to affect firm growth are controlled in our estimations including size, *age*, export participation, ownership, and market structure. The major variables of interest are FDI and its interactions with firm productivity and efficiency.

According to the results in all the columns, firm size affects growth negatively and significantly suggesting that small firms are more likely to grow faster. Firm age has also similar but insignificant effects (except Column 2) on growth, which is in agreement with most literatures on firm growth. Participation in the export market increases growth of firms as the coefficient of *Export* is positively and highly significant. The negative and highly significant coefficient of *private* indicates that public-owned firms grow faster than private firms. The positive significance (at less than 5%) of CI in all the columns indicates that firms in more concentrated sectors grow faster than firms in less concentrated sectors. Unlike what we have seen in TFP regression, the effects of the FDI variable on growth are different when computed at two- and four-digit ISIC. Columns 1 to 3 of Table 6.5 indicate that FDI plays a positive role in the growth of firms similar to that of TFP, confirming Hypothesis 2a. The finding supports Fotopoulos and Louri (2004) who found a positive effect of foreign presence on firm growth in Greece with increasing of the effect along the growth quantiles.

Our results (Columns 2 and 3) indicate that the spillover effect is higher when interaction is controlled. Corresponding to the interaction terms, the strong significance of the coefficients shows that firms with high relative performance benefit more from FDI than those with lower performances. The positive and strong significance of the coefficient of REL_{TFP}xFDI shows that the effect of FDI is stronger among firms with high relative productivity. The negative and strong significance of the coefficient of EFGxFDI, however, indicates that the positive effect of high foreign presence is lower for firms with high efficiency gap. Equating REL_{TFP} with absorptive capacity and EFG with technology gap, we can say that firms with higher absorptive capacity and/or firms with lower technology gap reap greater benefits from the presence of foreign firms in their respective sectors. This provides strong support for Hypothesis 2b.

However, striking differences appear in the effect of FDI on firm growth when computed at two-digit ISIC (Columns 4 and 5). Results are robust with and without the interaction term indicating the negative effect of FDI. This effect is likely to be related to the degree of concentration of foreign firms in a sector. As it is known with more aggregated sectoral classification, foreign firms increase in number and concentration. As a result, the demand stealing effect and competition for inputs would exert a counterproductive effect on local firms. Besides, the heterogeneity of firms in terms of size increases at such aggregation. Unlike positive spillover, the effect of negative horizontal spillover varies with firm size distribution (Damijan *et al.*, 2013) and the extent of foreign presence (Girma *et al.*, 2014). According to Girma *et al.* (2014), the effect of FDI on the productivity of local firms in an industry region cluster is strongly negative and this effect is more negative with increasing presence of foreign firms up to a threshold of about 40% foreign ownership. This evidence and the fact that the mean proportion of foreign firms in a four-digit industry (0.037) is far lower than the proportion in a two-digit (0.058) would help understand the observed difference in the current study.

	(1)	(2)	(3)	(4)	(5)
growth	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)	Coef. (RSE)
$Size_{t-1}$	-0.021*** (0.003)	-0.017*** (0.003)	-0.021*** (0.003)	-0.023*** (0.003)	-0.039*** (0.004)
Export	0.052*** (0.009)	0.039*** (0.008)	0.045*** (0.009)	0.057*** (0.010)	0.036*** (0.011)
lnage	-0.002 (0.001)	-0.003** (0.001)	-0.002 (0.001)	-0.001 (0.001)	-0.001 (0.002)
Private	-0.029*** (0.007)	-0.021*** (0.007)	-0.024*** (0.007)	-0.032*** (0.008)	-0.039*** (0.009)
FDI	0.037* (0.021)	0.186*** (0.044)	0.202*** (0.041)	-0.055** (0.027)	-0.081*** (0.031)
REL_{TFP}xFDI		0.072*** (0.027)			0.175*** (0.018)
REL_{TFP}					0.088*** (0.007)
EFGxFDI			-0.343*** (0.062)		
CI	0.114** (0.045)	0.092** (0.046)	0.114** (0.044)	0.096** (0.042)	0.080** (0.038)
_cons	0.113*** (0.020)	0.100*** (0.020)	0.111*** (0.019)	0.131*** (0.021)	0.383*** (0.031)
Dummies	Year & sector				
No. of obs.	7222	7222	7222	7223	7223
No of firms	2074	2074	2074	2074	2074
No. of inst	822	922	921	876	858
AR(1)	0.000	0.000	0.000	0.000	0.000
AR(2)	0.159	0.149	0.088	0.063	0.146
Hansen test	0.399	0.686	0.502	0.718	0.462

***, **, * stand for 1%, 5%, and 10% levels of significance, respectively.

Table 6.5 Result of sales growth regression (SYSGMM)

The contrasting findings on the growth effect of FDI at the two different levels of classification indicate the importance of optimizing entry of foreign firms to maximize benefits from FDI. Nevertheless, the general implication on the effect of horizontal spillover is based on the more disaggregated sectoral classification (four-digit) as also suggested by Smeets (2008). Accordingly, we conclude that FDI stimulates firm growth with heterogeneity of this effect based on differences in their absorptive capacity measured by relative performance of firms.

6.5. CONCLUSION

In this paper, we have investigated the productivity and growth effect of the presence of foreign firms in the Ethiopian manufacturing sector. We used data from the annual census of large and medium size manufacturing sector of the country. We applied a two-step estimation strategy where TFP was first estimated by using semi-parametric method following Levinsohn and Petrin (2003) to deal with simultaneity. Firm growth was estimated based on the growth rate of firms' sales. In the second step, we used the extended system GMM to tackle endogeneity of variables and take the dynamic nature of the growth and TFP into account. We examined the mediating role of relative productivity as a proxy of absorptive capacity in spillover.

Our finding shows that higher presence of foreign firms (FDI) in a sector increases the TFP of domestic firms when FDI is computed at both two-digit and four-digit industrial classification. However, the effect of FDI on the growth of domestic firms appeared to be different at the two different industrial classifications, which can be seen as the unique contribution of the current study. Specifically, we found negative significant effect of FDI on the growth of domestic firms in the two-digit industry. On the contrary, the effect turned to be positive and significant when FDI was computed at the four-digit industry. This implies that the negative competition effect overweighs the positive learning effect of FDI at a broader classification while the reverse is true at a narrower classification. The competition seems to be in terms of resources rather than market as most FDIs in Ethiopia are resource-oriented types. This has important policy implications for the government in terms of selecting foreign investments and the institutional support required to help domestic firms benefit from FDI than to be selected out by it. Nevertheless, if we take the fact that FDI at four-digit industry best represents horizontal spillover effect, we can generalize that FDI has positive spillover effect in terms of both productivity and growth of domestic firms in Ethiopia. Moreover, the positive interaction effect between relative productivity and FDI, on the one hand, and negative interaction between FDI and technology gap, on the other, indicates the fact that positive spillover effect is greater for firms with high absorptive capacity than those with low absorptive capacity.

The general picture derived from this paper is that promoting FDI would help domestic firms in Ethiopia learn better technologies and hence improve their performances. Apart from its static benefit of improving production capability, increasing inflow of FDI to Ethiopia would involve dynamic benefits to domestic firms through building innovation capabilities (Lall, 2006), which is crucial in the process of developing the industrial sector. However, theoretical and empirical literatures suggest selective attraction of FDI for less-developed countries so that they would host foreign firms with maximum potential of positive externalities and linkages to domestic firms. It would also be helpful to prioritize export-oriented and efficiency enhancing foreign firms over market-oriented and resource-oriented entrants.

However, it is worth mentioning two main limitations of this paper. First, similar to any econometric study, it could not provide an explicit elaboration on the mechanisms through which domestic firms learn from FDI through horizontal spillover. Second, the study could not include vertical spillover effect due to lack of appropriate data. It is also worth mentioning the fact that we used productivity and efficiency-related measure of absorptive capacity instead of the more commonly used proxies such as R&D and the quality of human resource. Therefore, future research needs to be directed at examining vertical spillover effects and in-depth analysis of the effect of foreign presence using case studies.

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